Electric Power for Industrial Operations—
Central Station Statistics—Articles on Public Policy

Electrical World

New York, November 3, 1917 McGraw-Hill Publishing Co., Inc. Vol. 70, No. 18 10c a copy

Engineering Library
NOV 6 1917
UNIV. OF MICH. LIBRARY

HUGHES
Electric Table Stoves
and Portable Ovens
(Attachable to any 660-watt receptacle)
have the same cooking features and sturdy construction as their parent—the standard Hughes range
—offering a sales possibility to Central Stations of introducing the conveniences of electric cooking in every home and community.
HUGHES ELECTRIC HEATING CO.
CHICAGO—TORONTO

Quality That Speaks

Far more than we can say about Weston pre-eminence is revealed fully, unmistakably, emphatically in every detail of

Weston

Indicating Electrical Measuring Instruments

Their superiority is so marked, so easily demonstrated by test, that only one decision will be consistent after you have made comparisons.

Model 214 Frequency Meter

Weston Round Pattern A. C. Switchboard Instruments, of uniform front projection, comprise Wattmeters, both single and polyphase; Voltmeters, Ammeters, Power Factor Meters, Frequency Meters and Synchroscopes.

Weston Models include complete groups for Portable and for Switchboard Service on A. C. and on D. C. circuits, together with many instruments designed for special purposes. Write for particulars regarding any need.

Weston Electrical Instrument Co.
13 Weston Avenue, Newark, N. J.
23 Branch Offices in the Larger Cities

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN
Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70 NEW YORK, SATURDAY, NOVEMBER 3, 1917 No. 18

The Transportation Tangle

EVERY one who has interest in the shipment of electrical supplies and necessities is feeling the pinch of bad freight service. The number of express shipments has risen enormously under this compulsion, as have also the transportation charges which must stand on the purchaser's books in one form or another. Quite aside from the matter of fuel, everything that is necessary in electrical service is in the same unhappy condition. Embargoes come and go without warning, and in certain parts of the country where munition works are dominant there is virtually, if not officially, an embargo all the time. If the public service corporations are to carry on business successfully, they must somehow be able to get supplies just like other manufacturing concerns, and it is worth while stopping to look into the nature of some of the difficulties. The chief difference between transportation by freight and by express lies in organization. Freight shipments are delayed, not by insufficient speed of the trains, but by getting tied up at junctions, by cars getting lost on the sidings, and in general by a rather slovenly way of handling the whole matter. Part of the difficulty lies with the railway men themselves, who are just now swamped with an amount of traffic enormously greater than they have been used to taking care of; but the chief burden is chargeable not to inefficiency but to incompleteness of the organization complicated by grave faults on the part of the shippers.

One of the most formidable difficulties with which railway men have had to contend in the past is inability to compel shippers to load and unload cars promptly. Freight cars are convenient storage space for many purposes. If a little mistake has been made in the preparation of a shipment for an expected date, it is a perfectly simple thing to prevent the rolling stock from rolling while awaiting its completion. If it is inconvenient to unload a car to-day, to-morrow or next day will serve. Besides this there is the still further abuse of material being held up in cars waiting for a change in the market, a situation of which many examples have been pointed out in the newspapers, with reference particularly to speculative food shipments. Now, if consignees are going to get goods with any degree of promptness, all must co-operate in seeing that no car is delayed an hour beyond the time necessary for the getting of goods which are ready at hand into the car or getting them out into storage.

The possible function of the electric roads in a carefully planned freight-carrying system ought to be studied very thoroughly. Very many electric roads have freight franchises already, and in this time of necessity a great extension in freight-carrying privileges would seem desirable. Virtually all the electric roads are of standard gage and have roadbed and rails capable of carrying freight cars. It would be somewhat astonishing to the average man to see how many efficient routes between important termini could be worked out over existing electric roads with a little increase of the facilities for interchanging traffic between them and the steam roads. The free use of the electric lines would very frequently put an important parallel route into service. The electric roads are the capillaries of the industrial circulation, and when an artery of traffic is tied they can be put to important, even if abnormal and temporary, use.

Minimum Cost of Transformer Design

A CONSTANT-POTENTIAL lighting transformer is a device for delivering power at standard frequency to a secondary circuit when connected to constant-potential, high-tension mains. Under such conditions it might be supposed that the form, dimensions and weight of a transformer for a given output could be accurately determined and fixed. As a matter of experience, however, there are no fixed and definite designs or dimensions for a transformer. It is impossible to say that any single design or set of dimensions is the best possible. The question at once arises, for what best conditions is the design made? Is it for best efficiency at rated load, or for average load regardless of cost? Or is it for the minimum cost of production without regard to efficiency? Or, again, is it for minimum temperature elevation, or for best automatic voltage regulation? The various criteria of production cost, operating cost, bulk, weight, pressure regulation, efficiency, temperature elevation, factor of dielectric strength, etc., are more or less in mutual conflict; so that a design which inclines specially toward one of these criteria may not conform to the others. Under a given set of commercial conditions transformer designs tend to a certain general compromise, which results in a satisfactory transformer, all things being considered and in the order of their greatest importance.

Although transformer designs have to be compromises, and although the actual dimensions employed may range over moderately wide limits without departing from ordinary specified requirements, yet it is desirable to have rules for determining specific dimensions under narrower conditions than those ordinarily encountered. For example, it is desirable to be able to find the best design dimensions for a trans-

former in which economy of materials shall be the essential condition, or again for another transformer in which the minimum losses of power shall occur. These narrower problems may not be capable of being solved in general terms absolutely; but they may be capable of being solved for a particular type of structure, such as for a core transformer or for a shell transformer of known factory type, the detailed dimensions of which are to be found. When the designer possesses rules for solving these design problems, one by one, he is able to ascertain how far his final design for general compromise under multiple conditions departs from the best designs for each single condition in turn.

The article of Prof. B. C. Dennison which appears this week discusses several of these specific designs of constant-potential transformers, with particular reference to transformers supplying customers from distributing mains and where neither the currents nor the voltages are excessive.

It is interesting to observe that in Fig. 10 the total costs of core and coils entering into a series of designs for a given set of conditions are discussed with reference to certain dimensional ratios X, Y and Z. Over a reasonably wide range these curves are fairly flat, indicating that these ratios may be modified to a certain extent on each side of the minimum value without greatly increasing the total cost of material.

Industrial Applications of Electric Power

IN THIS issue Prof. C. E. Clewell presents the first of a series of articles relating to the broad field of engineering applications of electric power to industrial operations. There can be no doubt as to the vast influence which manufactured power has had in the industrial development of the country during the last few years. In fact, it is problematical whether this remarkable progress in manufacture would have been realized without the corresponding developments in ways and means of applying power which have characterized many steps of industrial efficiency.

As Professor Clewell points out, these applications of power have been greatly affected by the electric motor because of its high efficiency in both large and small sizes, and moreover by the increased flexibility in transmission and distribution permitted with electricity as a substitute for the older methods of line shafting and belt drives. In these articles, therefore, aside from the detailed discussions of various specific motor and control applications, an important emphasis will be given to the ways in which the motor has proved superiority over older methods and older factory power sources.

A significant feature of the first article is the large importance which it attaches to the engineering possibilities in this field of applied power. The peculiar character of the work calls for the specially trained engineer who has ability to analyze not only the electrical problems connected with the motor and its operation, but who can, moreover, analyze with equal skill the mechanical features of the machinery to be driven and thus combine in his solution the most efficient types of motor and control to operate the machinery at lowest first cost and the least possible operating expense.

That this is particularly difficult engineering is evidenced by the fact that more than ordinary trouble has been experienced in finding men capable of handling successfully the problems concerned with motor applications, including, as such problems do, a large proportion of mechanical as well as electrical engineering details, and often presenting perplexing and indefinite features. In other words, the special province of the application engineer is a given problem with many factors and indefinite relations which must be reduced to a definite basis by careful study and analysis.

Some of the ways in which such an analysis may be approached are shown by practical charts. Through these Professor Clewell indicates the processes of a manufacturing organization by definite outlines and thus the close relationship between the electric power problem and many of the branches in the average industrial organization, some of which at first glance might seem to have no connection with the economic influences produced by electric drive. One of the most striking points is the fundamental importance of the motor in the conservation of labor expense, a feature set forth clearly by contrasting the great differences between various typical industries on the basis of the value added to the product by manufacture.

In the study of factory power, and more particularly of the electric motor, the outstanding items of power economy and increased production may be looked upon sometimes as dependent merely on the relative electrical and mechanical efficiencies of the various motors, on the one hand, and the actual increase in output brought about through a motor-driven machine, on the other. However, as the author points out, while these two items do constitute the starting point in most of the problems, the expert is confronted with a large number of factors, any one or all of which may make up the net advantages included by these two primary items.

Any given example may thus be resolved into a study of the type of motor and control available for the particular requirements, corresponding study into the mechanical requirements themselves, and a summary of the operating conditions which may be expected to follow application of the motor. Furthermore, these considerations are rendered more valuable by proper emphasis upon the economies afforded by the adoption of such a system of drive in comparison with older methods. Since Professor Clewell has had the close co-operation not only of motor and controller manufacturers but also of prominent machine tool builders, the viewpoint is that of these two groups together with that of the user of the product. Taken as a whole, the subject matter is of unusual and widespread interest and includes factors of much importance to a number of the branches in electrical engineering and manufacturing.

Development in Incandescent Lighting

THE address before the Illuminating Engineering Society in Chicago by President Stickney, an abstract of which we published in last week's issue, is an interesting contribution to our knowledge of the current situation. The profession well knows how close Mr. Stickney has been to the development of modern lighting for some years past and how shrewd and sound his judgments of development are likely to be. An interesting fact which will be entirely new to the general public is the effect of the coming of war conditions on lamp manufacture. Some of the necessary materials are not so readily and cheaply available as they once were, and the engineers have been hard put to it at times to overcome the sudden difficulties with which they have been confronted. The manufacture of the modern incandescents is still in a state of flux, and the engineers are necessarily cautious about trying to fill rigid specifications lest they find that in so doing they run into unforeseen difficulties which may work out badly for the consumer whom improvements are intended to benefit. For the same reason they are fighting unusually shy of special lamps unless for well-defined purposes where the demand is clear and definite, such, for example, as the incandescent lamps for motion-picture projection. The use of the arc has long been a nuisance in this field of work, and certainly for the smaller houses not projecting pictures upon a large scale of magnification the new incandescent lamps will fill a long-felt want.

One very curious fact to which Mr. Stickney called attention is the relative increase of the carbon lamp, which we have generally supposed to be almost obsolete. For this condition Mr. Stickney could not suggest any really plausible explanation. Possibly, we think, the chief reason may be the fact that the smaller metallic-filament lamps are not yet generally on the free list of companies which furnish free renewals, and are relatively expensive in paid renewals. Often, therefore, the consumer would rather pay a larger bill for energy to avoid renewal expense, which sometimes comes in relatively large amounts. This is quite in line psychologically with the general fact that a man will pay an expected bill much more cheerfully than an unexpected one thrust suddenly upon him, even though the latter may represent, as it does in the case of incandescent lighting, a real economy. Pressure is being brought now on the users of light to cut down their consumption, and it strikes us that the wise method of doing this is to use lamps consuming less energy and more skillfully installed, instead of cutting out altogether illumination which is really valuable and ought not to be discontinued. Included in these efforts at economy must be the utilization to its fullest value of the gas-filled lamp. This is now only partly developed, but the signs are clear that in the future it is going to prove one of the important solutions of the economical lighting problem, to an extent which the average consumer does not yet realize.

Perhaps the most important single truth that Mr. Stickney drove home in his address is that at the present time there is a real demand for color modification in illumination. This takes two directions, first, approximation to daylight effects, and, second, variations of hue for purely artistic reasons. Light with modern lamps and the present prices for energy is astonishingly cheap, perhaps the cheapest manufactured necessity, and certainly the only one which has consistently fallen in price through a period of astounding increase in the cost of everything else one needs. The effect of the blue-bulb gas-filled lamp in the accurate presentation of colors is well known. Mr. Stickney points out that the CO_2 tube gives more precisely daylight values for color matching, but the blue lamp, or a lamp scientifically blue-screened, gives sufficiently close approximation for most purposes at very much higher efficiency. On the other hand, lamps tending toward a yellow or amber certainly give very rich interior lighting and a far pleasanter effect than the unmodified metallic-filament lamps. The interesting feature of their use is that by their means illumination of warm and pleasant tone can be obtained at a very moderate sacrifice of efficiency, leaving the unit far better economically than the older illuminants of the approximately desired hue. The National Electric Light Association has a committee working on this very problem, and ere long some definite and useful results should be obtained. To compensate the branch of lighting in which war conditions may render economy necessary comes the advent of protective lighting for the many works associated with the forwarding of the war. To go into details of these is manifestly improper. It is sufficient to say that well-installed protective lighting will probably go far to check those criminal activities the extent of which is already too evident. Despite the war, incandescent lighting is going forward, not backward, and the lighting companies on the whole are going to do more business instead of less.

The Coming Issues

THE second installment by Prof. C. E. Clewell on engineering problems involved in industrial motor and control applications will be presented in the next issue of the ELECTRICAL WORLD. He will discuss the tendency of industrial plants to adopt central station service under present conditions, pointing out the relative economy of privately developed and purchased energy. Cases will be cited where the isolated plant is essential, and the author will give an impartial statement of the advantages and economies of central station power. Another feature of the Nov. 10 issue will be a symposium on the success which has been attained with different makes of stokers in burning low-grade fuels. In addition, a contribution will be presented by A. O. Austin on the precautions to be observed in insulating high-voltage lines, the increased possibility of interruption with extension of a system or failure of a few units of a suspension string, etc., and there will be other timely contributions.

Electric Power for Industrial Operations

The Importance of Electric Drive in Industries Where Labor Constitutes a Large Percentage of Production Expense—Necessity of Basing Selection of Equipment on Practical Data

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

SYNOPSIS.—This article treats of the influence of electric power on manufacture as one of the principal items which have contributed to manufacturing development, the part played by manufacture in adding to the value of industrial products showing the large distinction which sometimes exists between the gross value of a product and the labor item. The points of special interest in any industry are discussed in their relation to the power problem. Analysis of the various items which go to make up the selling price and examples of certain methods are employed to contrast steam versus electric operation. The article is concluded by a brief discussion of the general grouping of industrial operations according to the nature of their load characteristics, with considerable emphasis on the principal advantages of electric motor drive and a summary of the ways and means whereby these advantages may be secured.

PROBABLY the most powerful and dominating single influence which has contributed to industrial development is the applicability of electric power to such a variety of purposes. The coming of the steam engine, in spite of its enormous beneficial effects, resulted in many limitations. Among these was the necessity of installing the engines near the factory floors because of the impossibility of mechanical power transmission over more than short distances. While the steam engine presented the possibility of high efficiencies in large sizes, it became relatively inefficient in small sizes. Moreover, there was no easy and convenient means for transforming the mechanical power of the engine into light, chemical energy or even heat, nor for efficiently breaking up the power supply required by a large factory floor into small units.

On the other hand, the development of electric generators and motors has been the means for the application of power in new ways, the motor in particular having permitted higher efficiency in small as well as large units. Moreover, the adoption of electric light and power in the various industries has been the basis of greatly increased flexibility in the arrangement of buildings and machinery, due primarily to the many advantages of power transmission and distribution in electrical rather than mechanical form.

With the increasing adoption of electric power for industrial purposes a new field has opened for the trained engineer in the study and handling of those special problems relating to industrial motor applications. To him is assigned the task of reducing the whole problem to a scientific and effectively practical basis. The following notes will indicate that the problem, while often involved and difficult, is susceptible to fairly definite analysis.

FACTORS IN THE VALUE OF AN INDUSTRIAL PRODUCT

Any comprehensive study of the motor application field should take due account at the outset of the elements which enter into the problem of manufacture. Foremost, perhaps, in these elements as related to the power problem is the value which is added to any product by manufacture. In other words, what part of the final value of any product has been due to the basic cost of materials and how much has been the result of workmanship during the operations of manufacture?

Several typical cases[1] are illustrated in Fig. 1. The first case shows the average condition for all manufacture. That is to say, of a total of somewhat over twenty billions of dollars given as the gross value of all manufactured products in 1909, about 40 per cent, or about eight and a half billions, represents the value added by manufacture.

In a case like the second in Fig. 1, where the value added by manufacture is only 12 per cent, it follows that the cost of materials forms a very high percentage of the final value, and it would be expected that the

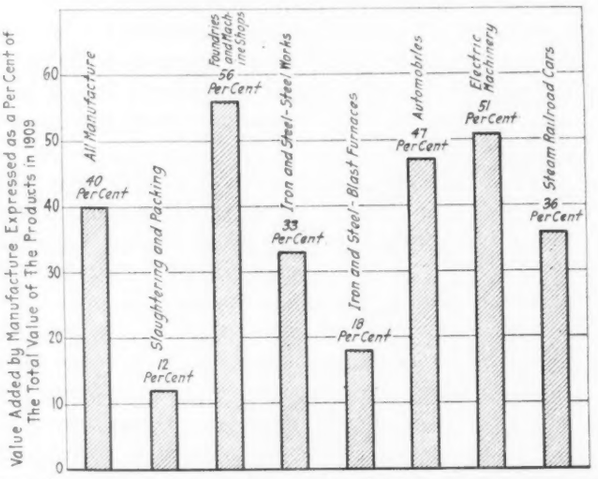


FIG. 1—PERCENTAGE OF THE TOTAL VALUE OF PRODUCTS IN CERTAIN INDUSTRIES CONTRIBUTED BY MANUFACTURE

labor item would be correspondingly small. This as a matter of fact is true, the wage-earners employed in the slaughtering and packing industry being only about one-sixth of those in the foundry and machine-shop industry in spite of the fact that the former, according to 1909 census reports, is higher in the gross value of products than the latter.

The reason for emphasizing this point is to call attention to the wide variations in the labor item for different industries, because, as will be pointed out in the development of the subject, the effects of economy in scientific motor applications often lie far more in the indirect result of the aid to labor in making possible more efficient production than in the direct results of economy through the use of more efficient motors with the attendant great reduction of mechanical losses

[1]Figs. 1, 2, 3 and 5 have been designed by the author on a basis of information found in the excellent papers on this subject by D. B. Rushmore, *Transactions A. I. E. E., Vol.* XXXIV, pp. 171, 1276, 1277 and 1282.

in contrast to line-shaft drive. Hence the greatest advantages of the motor may be expected in those industries where labor predominates or at least forms a relatively large proportion of the final gross value of any given product.

From a glance at the chart in Fig. 2 it might be concluded that the motor application problem is related

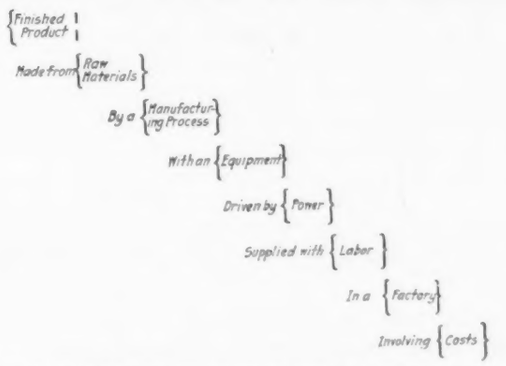


FIG. 2—DIAGRAMMATIC REPRESENTATION OF PRINCIPAL POINTS OF INTEREST IN ANY INDUSTRY

to only one or two of the items listed—power and possibly labor. A closer study will show, however, that practically all of the items are more or less intimately tied up with effective power supply. Thus the original and operating costs as well as the actual arrangements of buildings may be considerably influenced by the method of power supply. Labor, power and equipment are in like manner all influenced to a greater or less extent, the labor by its ability to do more and better work with a well-designed power supply, the power being decreased by any increase in the efficiency of the method of drive, and even the equipment itself often being modified both in original design and in its placement on the shop floors and its operation by the method of drive.

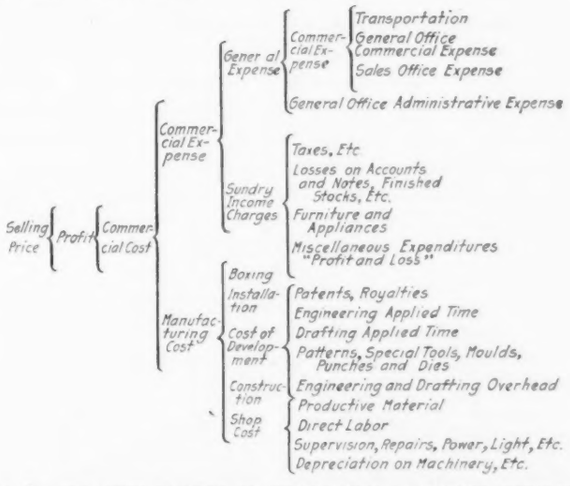


FIG. 3—RELATIVE VALUES OF FUNDAMENTAL POINTS INVOLVED IN THE COST OF A FINISHED PRODUCT

In somewhat the same manner it might be shown that one manufacturing process in contrast to some other process for accomplishing the same results may have a bearing either directly or indirectly on the power problem, and finally the nature of the raw materials will influence considerably the horsepower requirements of given machine tools and will also tend to influence the rate of production in certain cases.

Hence, as a general preliminary proposition, it may be concluded that practically every phase in the logical analysis of manufacture has in one way or another a larger or smaller relation to the question of the power supply. The purpose, however, in amplifying these interrelations is not to magnify unduly the power

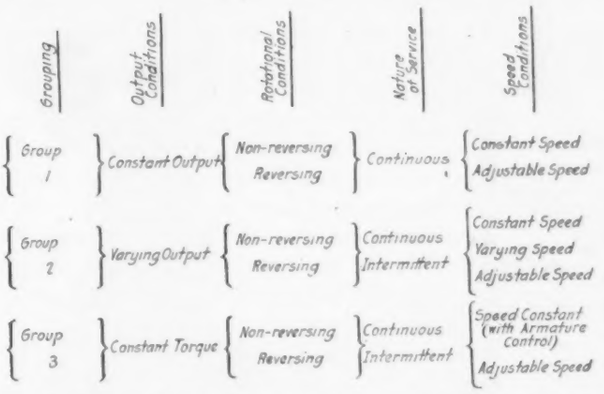


FIG. 4—ONE PLAN OF GROUPING, BASED ON THE CHARACTERISTICS OF THE VARIOUS TYPICAL LOADS

problem, but merely to point to the fact that the influences of motor drive are usually broader and more numerous than that covered merely by economy through reduced friction and belt losses. This and subsequent discussions will therefore treat the situation from the broader rather than the more narrow point of view.

COST FACTORS IN THE FINISHED PRODUCT

Additional interest is attached to a chart like that of Fig. 2, where the items in the cost of a finished product are analyzed. For instance, by studying Fig. 3, starting with the selling price at the extreme left, the various items which contribute to the final price may be seen to depend on various groups of expense. Thus the commercial cost of a product is dependent on the two principal items of commercial expense and of manufacturing cost. In the present study the last-named item is the one of interest. Moreover, it may

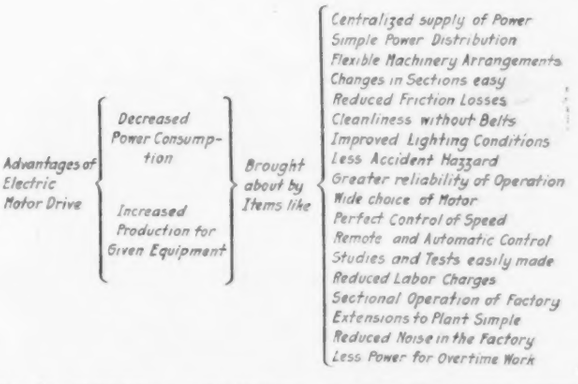


FIG. 5—PRINCIPAL ADVANTAGES OF ELECTRIC MOTOR DRIVE AND CHANNELS THROUGH WHICH THEY MAY BE SECURED

be noted that the manufacturing cost is itself dependent on a number of factors, whereas the advantages of electric drive will subsequently be shown to influence mainly the sub-item of shop cost, and specifically that part of the shop cost which relates to direct labor and to power.

This chart is very useful in gaining a comprehensive view of the industrial power problem in its bear-

ing on the broad general question of the total or final cost of a product, and it will be found advantageous to keep these relations in mind in connection with the more specific discussions to follow.

If any given case of electric drive is selected at random, it will usually be found that a quantitative estimate of the advantages of the electric drive in com-

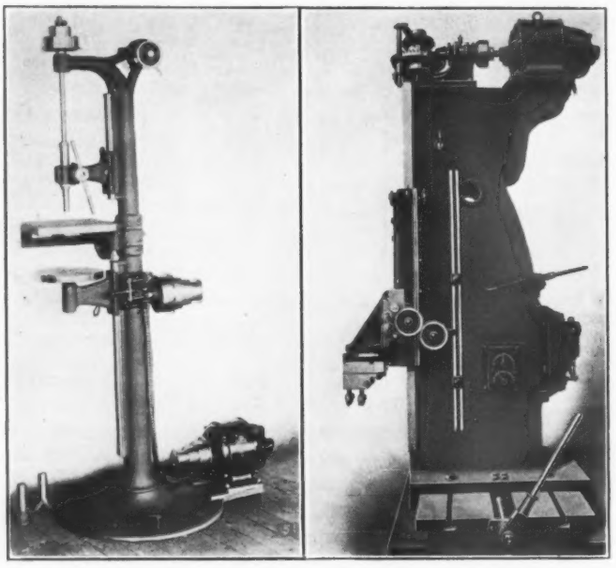


FIG. 6—SELF-CONTAINED INDIVIDUAL MOTOR DRIVES EMPLOYING BELT AND GEARING RESPECTIVELY

parison with other possible methods of power supply may be made by a careful analysis of the individual items involved in the operation of the particular device in question. To illustrate this point certain figures are presented in Tables I, II and III, based on the operation of large excavating shovels by steam and by electric power.[2] In Table I, for example, an itemized list of all labor charges is given for such a shovel, first, for steam operation, and, second, for electric operation. The totals show a saving in the labor

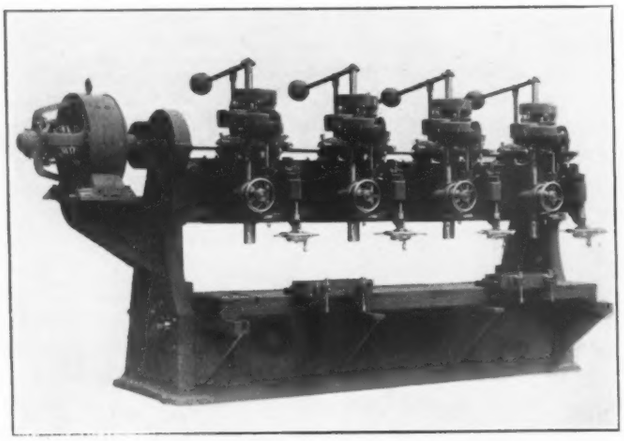


FIG. 7—MODIFIED FORM OF INDIVIDUAL ELECTRIC DRIVE WHERE ONE MOTOR SUPPLIES POWER FOR A NUMBER OF OPERATIONS

charges of $9 per shift in favor of electric operation, this saving being due primarily to the elimination of certain labor, such as that of fireman and coal passer, which is obviously unnecessary with electric drive.

[2]These three tables are based on data of H. W. Rogers found in the *Transactions A. I. E. E.*, Vol. XXXIV, pp. 1332-1334.

Table II and Table III give a more complete summary.

These two tables are included chiefly to bring out a very important point in connection with the compilation of estimates on the comparative total costs for electric and other methods of drive. To illustrate, Table II gives the four items of interest, depreciation, repairs and labor for each of the three cases of steam, direct-current motor and alternating-current motor

Steam Operation	$6.00	Shovel Runner	$6.00	Electric Operation
	4.00	Craneman	4.00	
	2.50	Fireman		
	10.50	Six Pitmen	10.50	
	1.75	Watchman		
	1.50	Coal Passer		
	2.50	Teaming		
	1.50	Oil and Waste	0.75	
	$30.25	Totals	$21.25	
		Saving per Shift:	9.00	

TABLE I—SUMMATION OF THE LABOR ITEMS CHARGEABLE TO EACH SHIFT IN THE GENERAL CASE OF EXCAVATING SHOVELS

drive on a basis of one shift for a day. The direct-current motor drive shows a considerable saving over the steam drive per day while the alternating-current motor drive is somewhat more expensive than steam operation, despite the lower labor item, because of higher interest and repair charges.

Table III, by contrast, shows that when the corresponding figures are tabulated for three shifts per day the labor item in each case becomes larger in proportion to the fixed charges. The alternating-current motor drive becomes less expensive than the steam drive,

	Steam Driven	Direct Current Motor Driven	Alternating Current Motor Driven
Interest	$ 5.20	$ 7.75	$10.85
Depreciation	4.03	6.00	8.43
Repairs	8.66	7.75	10.85
Labor	30.25	21.25	21.85
Totals:	$ 48.14	$ 42.75	$ 51.98

TABLE II—SUMMARY OF TOTAL COSTS PER SHIFT FOR VARIOUS METHODS OF SHOVEL DRIVE

while the direct-current motor is even more favorable than indicated by Table II. These figures indicate then the general basis on which comparisons of various methods of drive may be made, and they furthermore show what large changes may be made by slight readjustments in the assumptions made.

Every precaution possible should be taken with such problems to be guided by figures which are based on practice rather than on assumptions. To use figures of the latter type in selecting equipment involves the risk not only of initial mistakes, but also of possible daily losses throughout years of service simply be-

	Steam Driven	Direct Current Motor Driven	Alternating Current Motor Driven
Interest	$ 5.20	$ 7.75	$10.85
Depreciation	4.03	6.00	8.43
Repairs	13.00	11.63	16.28
Labor	90.75	63.75	63.75
Totals:	$ 112.98	$ 89.13	$ 99.31

TABLE III—TOTAL COSTS PER THREE SHIFTS FOR VARIOUS METHODS OF DRIVING EXCAVATING SHOVELS

cause the original choice was based on theoretical rather than practical considerations.

One of the outstanding features in motor application work is the fundamental importance of the load to be driven. The analysis of the problem usually resolves itself into a careful study of the requirements

of the load, an equally careful study of the operating characteristics of the available motors for the work, and finally the suitable adaptation of one to the other.

A general classification of load characteristics applicable to all cases will be given at this point, since it serves to give a broad view of the physical items involved in any particular problem. Fig. 4 is presented to cover such a general classification in terms of the output necessary to maintain the load, and the rotational, service and speed conditions which are usually experienced in practice.[3] The advantage of such a chart lies in the fairly complete picture it gives of the possible variables in any given problem, and of the kinds of things which constitute the basis for the work of the expert in this field.

There are two chief elements of advantage in electric drive, namely, decreased power consumption and increased production. These items, however, are not always easy to reduce to a tangible, convincing basis unless the other advantages (Fig. 5) which go to bring about power savings and larger production are carefully analyzed in whole or in part and evaluated at least as far as possible to definite figures. Many of the items to the right in Fig. 5 are not readily determinable in the every-day operations of a plant, even where every facility may be provided for the study of the situation. It is just here that the unusual qualifications of engineers for such work become apparent.

With increasing experience on the part of electrical manufacturers it is possible that the motor application field will gradually become standardized. As a matter of fact, the mass of data already available from practical cases is very great, but in spite of this fact persons who are most deeply concerned with the engineering development of industrial motor and control equipment do not hesitate to admit that there is still much room for improvement and that very little is known even to-day about the action and physical refinements of certain parts of the control equipment. From this standpoint, therefore, as well as from that of the great importance of the whole subject to industrial efficiency, the study and analysis of some of the well-defined phases of the question presents a field of utmost concern, both to the engineer and to the manufacturer.

[3]Fig. 4 has been designed by the author on the basis of a somewhat similar table due to A. C. Lanier, *Transactions A. I. E. E.*, Vol. XXXIV, p. 176.

August Central Station Operation

Returns Indicate Total Earnings for the Month of $37,000,000 for Light and Power, an Increase Over August, 1916, of 14 per Cent, and an Output of 1,910,000,000 Kw.-Hr., an Increase Over the Same Month of 19.5 per Cent

RETURNS received by the ELECTRICAL WORLD from 56 per cent of the total rated generating capacity of the electric light and power central stations of the United States for August last indicate that the earnings of the entire industry throughout the country for that month in the sale of energy for light and power companies were $37,000,000, an increase over the previous August of 14 per cent. The output for the same month for the entire industry was 1,910,000,000 kw.-hr., an increase over August, 1916, of 19.5 per cent.

TABLE I—CENTRAL STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percentage of Industry Represented	Income from the Sale of Energy			Kw.-Hr. Output		
		1916	1915	Per Cent Increase	1916	1915	Per Cent Increase
Sept.	64	21,432,000	18,600,000	15.2	1,268,339,000	1,037,976,000	21.2
Oct.	64	22,882,000	20,164,000	13.5	1,347,502,000	1,125,132,000	19.9
Nov.	64	24,819,000	21,744,000	14.4	1,396,537,000	1,148,221,000	21.7
Dec.	62	25,306,000	22,029,000	15.0	1,345,883,000	1,112,280,000	21.0
1917		1917	1916		1917	1916	
Jan.	63	27,408,000	23,969,000	14.4	1,495,829,000	1,180,884,000	26.7
Feb.	63	25,204,000	22,295,000	13.1	1,240,995,000	1,036,014,000	20.0
March	64	23,949,000	20,913,000	14.6	1,409,129,000	1,139,453,000	23.6
April	63	22,927,000	20,165,000	13.8	1,328,092,000	1,085,554,000	22.5
May	62	23,369,000	20,307,000	15.2	1,459,085,000	1,163,483,000	25.3
June	62	22,644,000	19,416,000	16.6	1,345,537,000	1,101,493,000	22.3
July	61	21,727,000	18,599,000	16.8	1,305,318,000	1,068,922,000	22.1
August	56	20,306,000	17,829,000	14.0	1,260,284,000	1,056,462,000	19.5

The percentage of increase over the corresponding month of previous years for August was noted to be

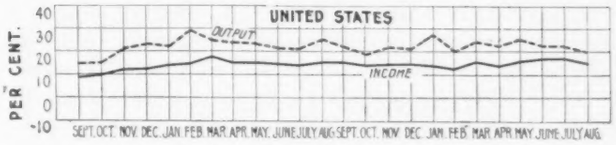
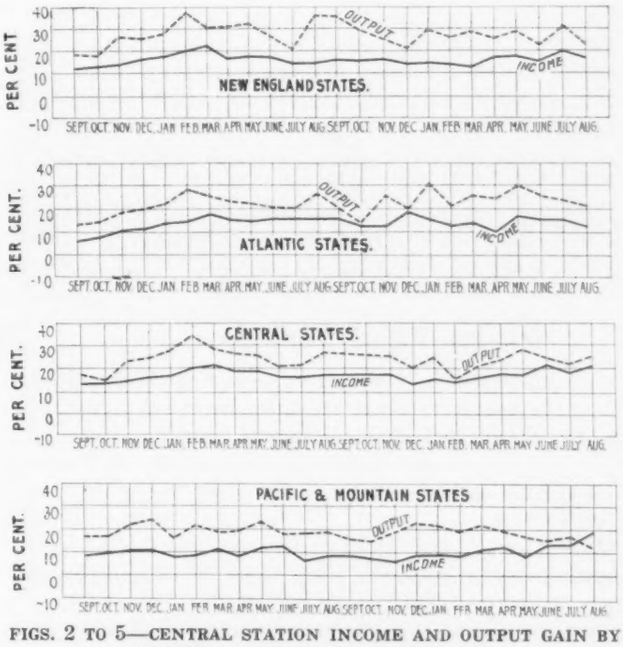


FIG. 1—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES



FIGS. 2 TO 5—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

slightly less than for the preceding months. This is especially true of the East, as will be noticed in Table II. During the month of August the Eastern states underwent a very trying experience with hot weather. Numerous plants found it advisable to close down for a day or two during the height of the heat wave. The same was true of office buildings and stores. During those nights people prepared to stay outdoors, and for that reason the consumption of energy for electric lighting was somewhat less. There were also some labor disturbances, particularly in some of the Western mining regions, which caused a cessation of operations in many instances extending over a period of days.

TABLE II—CENTRAL STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States		Per Cent Increase	Percentage of Industry Represented	Atlantic States		Per Cent Increase	Percentage of Industry Represented	Central States (Illinois Excluded)		Per Cent Increase	Percentage of Industry Represented	Pacific and Mountain States		Per Cent Increase
			1916	1915			1916	1915			1916	1915			1916	1915	
INCOME	September	65	2,315,000	1,982,000	16.8	66	8,631,000	7,445,000	16.0	56	6,505,000	5,537,000	17.8	88	3,979,000	3,644,000	9.2
	October	65	2,684,000	2,331,000	15.2	65	8,887,000	7,930,000	12.1	56	6,968,000	5,895,000	18.2	87	4,213,000	3,889,000	8.3
	November	65	2,912,000	2,516,000	15.7	65	10,061,000	8,859,000	13.5	56	7,410,000	6,313,000	17.4	87	4,246,000	3,947,000	7.5
	December	65	3,203,000	2,814,000	14.0	66	11,059,000	9,348,000	19.6	56	7,898,000	6,997,000	13.0	75	2,987,000	2,735,000	9.3
	1917		1917	1916			1917	1916			1917	1916			1917	1916	
	January	64	3,181,000	2,762,000	15.1	66	11,400,000	9,874,000	15.6	56	8,081,000	7,013,000	15.2	86	4,602,000	4,020,000	9.5
	February	64	3,039,000	2,686,000	13.1	65	10,249,000	9,021,000	13.6	55	7,471,000	6,530,000	14.4	86	4,284,000	3,926,000	9.2
	March	64	2,861,000	2,547,000	12.3	65	10,203,000	8,902,000	14.7	56	6,692,000	5,754,000	16.5	86	4,193,000	3,780,000	11.0
	April	64	2,756,000	2,357,000	17.0	65	8,601,000	7,765,000	10.7	56	7,132,000	6,094,000	7.0	86	4,282,000	3,821,000	12.1
	May	64	2,640,000	2,253,000	17.2	65	9,495,000	8,118,000	16.9	52	6,912,000	5,914,000	16.9	86	4,173,000	3,883,000	7.5
	June	64	2,613,000	2,262,000	15.5	65	9,281,000	8,017,000	15.7	51	6,687,000	5,525,000	21.0	80	3,914,000	3,488,000	12.2
	July	65	2,382,000	1,983,000	20.2	65	8,919,000	7,687,000	16.1	53	6,649,000	5,606,000	18.6	80	3,734,000	3,288,000	13.4
	August	65	2,274,000	1,946,000	16.8	55	7,567,000	6,744,000	13.7	52	6,807,000	5,624,000	21.0	77	4,052,000	3,437,000	18.0
KW.-HR. OUTPUT			1916	1915			1916	1915			1916	1915			1916	1915	
	September	65	98,350,000	73,343,000	34.2	66	446,534,000	369,815,000	20.8	56	387,626,000	307,485,000	26.2	88	335,817,000	288,332,000	16.4
	October	65	107,756,000	83,705,000	28.8	65	426,151,000	373,705,000	14.2	56	408,364,000	324,509,000	25.9	87	355,014,000	306,828,000	15.8
	November	65	111,873,000	89,015,000	25.7	65	533,252,000	424,746,000	25.6	56	415,491,000	334,044,000	24.4	87	346,847,000	293,518,000	18.2
	December	65	117,763,000	97,387,000	21.0	66	535,410,000	444,923,000	20.4	56	425,510,000	354,258,000	20.0	75	256,006,000	206,838,000	23.8
	1917		1917	1916			1917	1916			1917	1916			1917	1916	
	January	64	120,211,000	93,163,000	29.1	66	564,699,000	429,432,000	31.5	56	437,923,000	351,335,000	24.5	86	363,094,000	298,990,000	21.4
	February	64	110,114,000	88,324,000	24.7	65	418,407,000	341,877,000	22.5	55	373,988,000	323,158,000	15.8	86	326,891,000	274,079,000	19.3
	March	64	121,434,000	95,515,000	27.2	65	539,028,000	425,376,000	27.0	56	383,046,000	311,841,000	23.0	86	365,541,000	301,721,000	21.3
	April	64	108,968,000	87,237,000	25.0	65	449,445,000	362,752,000	24.0	56	390,103,000	317,505,000	22.9	86	368,557,000	309,474,000	19.1
	May	64	110,991,000	86,675,000	28.3	65	527,004,000	405,719,000	30.3	52	415,795,000	325,986,000	27.7	86	394,554,000	336,541,000	17.3
	June	64	105,312,000	85,856,000	22.7	65	496,784,000	392,405,000	26.5	51	391,070,000	315,852,000	24.0	80	341,524,000	298,544,000	14.5
	July	65	99,440,000	75,624,000	31.5	65	494,965,000	396,538,000	24.8	53	376,201,000	309,415,000	21.7	80	333,316,000	287,092,000	16.1
	August	65	102,090,000	82,581,000	23.6	55	412,540,000	340,831,000	21.0	52	410,774,000	329,166,000	24.8	77	332,482,000	301,332,000	10.5

The five tables that have been presented for some time in this article showing the percentage of increase over the corresponding months of previous years by companies grouped according to size have been discontinued owing to the form of report used by certain properties. The properties have been grouped, and therefore it is not possible to show the size of localities actually served.

The accompanying curves show graphically the results of increase in per cent as contained in Tables I and II.

Oxygen-Filled Tungsten Lamp

A tungsten lamp which overcomes the deterioration set up by destructive current discharges through chlorine vapors evolved from substances introduced into the lamp bulb to prevent blackening is the work of Ernest Friederich, Berlin, Germany, disclosed in patent No. 1,240,700.

According to the inventor, it is contemplated that the tungsten incandescent body shall burn in an atmosphere which contains oxygen of low pressure. Strange to say, oxygen of low pressure does not noticeably attack the white-hot tungsten filament or wire, but in the colder zones of the lamp oxidizes the vaporized tungsten to tungsten trioxide. This oxide is not volatile and is deposited on the glass bulb and other parts of the lamp, but the deposit is practically colorless compared with the deposit of tungsten metal. In fact, the non-volatility of the reaction product formed is of importance, for the pressure in the lamp is not increased and gas discharges through the gaseous medium are prevented. The definite effect of the oxygen occurs at pressures so low that they cannot be measured by the ordinary methods, since the pressure is always less than five one-thousandths of a millimeter of mercury and usually less than one one-thousandth of a millimeter.

The best effects cannot be obtained by simply filling the lamps with a small amount of gaseous oxygen or by imperfectly exhausting them. Under such circumstances the oxygen would very quickly disappear during the burning of the lamp. By introducing into the interior of the lamp substances which at the temperature and under the conditions which prevail in the lamp have a certain small oxygen pressure due to dissociation or decomposition they give up continuously as much oxygen as is consumed by the oxidation of the vaporized tungsten. Some of the suitable substances are oxides, peroxides, nitrates, nitrites, chlorates, perchlorates, chromates, bichromates, etc. In particular, manganese superoxide is very satisfactory and barium chlorate especially so. It may be noted that some of these substances may be decomposed more or less in the lamp during burning, or perhaps during the exhaustion of the bulb which usually takes place at a somewhat high temperature. For example, the barium chlorate may be decomposed into barium chloride and barium perchlorate, in which case perhaps the latter would be the effective substance, or potassium permanganate can be decomposed into potassium manganate and manganese superoxide.

Minimum-Cost Method of Transformer Design

First of Two Articles Applying the Method Worked Out to Shell, Core and Multiple Magnetic Circuit-Type Transformers with Uniform and Non-Uniform Flux Density

BY B. C. DENNISON

Assistant Professor of Electrical Engineering, Carnegie Institute of Technology, Pittsburgh, Pa.

SOME time ago it came to the notice of the writer that Charles LeG. Fortesque with others had worked out methods of theoretical transformer design, deriving the ideal values of the ratios of height to width of opening, width to depth of core, and core area to coil area, in order that for any assumed values of copper and iron density the design might give either maximum efficiency or minimum cost. The method, in brief, was to express the volumes of iron and copper in terms of the variables mentioned and so write the loss (or cost) equation; then, by taking partial derivatives with respect to each of the three variables and equating to zero, to solve for numerical values under the conditions of any particular design.

The writer is unaware of the form in which these results finally appeared, but being then at work along similar lines in the attempt to develop a method—one which should be more satisfying than that of Arnold—of determining the theoretically correct proportions of the transformer in a given design, his interest was stimulated and directed by this suggestion, and the results outlined in this paper were gradually worked out. He believes that credit for the general method should be given to Mr. Fortesque.

DESIGN CONDITIONS CONSIDERED

The problem under consideration is to determine the theoretically correct proportions and dimensions for constant-potential transformers for these conditions:

Case I.—For assumed values of flux and current density to find the dimensions giving the maximum efficiency for a transformer of given kva. frequency and voltage.

Case II.—For assumed values of flux and current density to find the dimensions giving minimum cost in a given transformer.

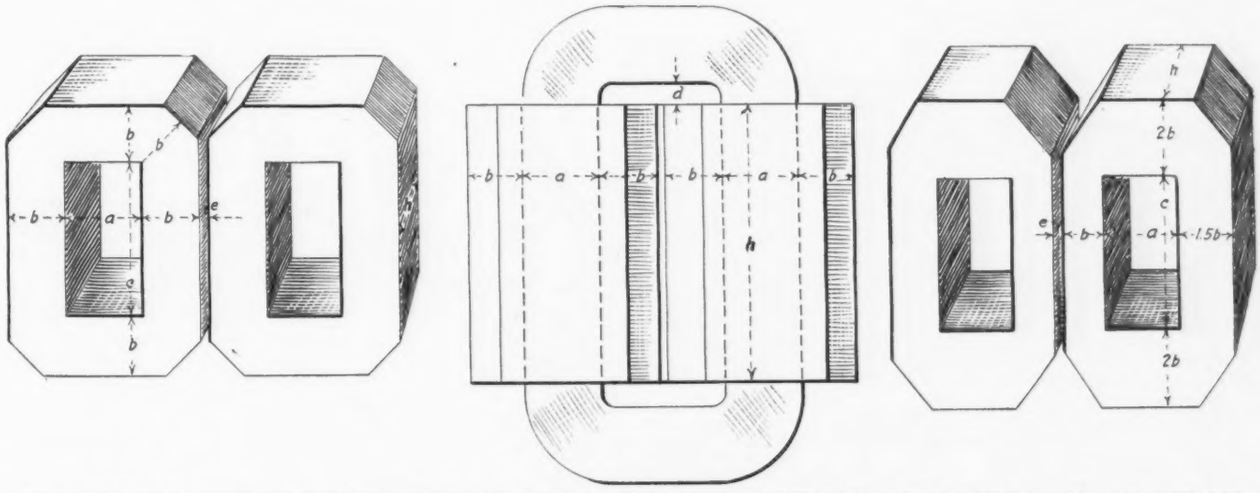
Case III.—For an assumed ratio of iron and copper losses to find the dimensions giving minimum cost for a transformer of given rating.

These cases will be investigated for the following types of transformer: (A) Shell-type, uniform flux density; (B) shell-type, non-uniform flux density; (C) core-type, uniform density, rectangular cores; (D) core-type, non-uniform densities, rectangular cores, and (E) multiple-magnetic-circuit transformers, non-uniform densities, rectangular cores.

SYMBOLS EMPLOYED IN DEVELOPING FORMULAS

The following symbols will be employed.

A_i = gross area of iron core.
A_o = gross area of coils in opening.
c = height of opening (see Fig. 1).
a = width of opening.
h = gross depth of core section.
b = width of single core.
k_i = space (stacking) factor of iron.
k_c = space factor of copper.
V_i = net volume of iron.
V_c = net volume of copper.
w_i = loss per cubic inch of iron core.
w_c = loss per cubic inch of copper.
C_i = cost per cubic inch of core, including labor.
C_c = cost per cubic inch of copper, including insulation and labor.
$P = A_i \times A_o$.
d and e = clearances (see Figs. 1 and 2).



FIGS. 1, 2 AND 3—CORE AND COMBINED COILS AND CORES OF SHELL-TYPE TRANSFORMER FOR UNIFORM FLUX, ALSO CORE FOR NON-UNIFORM FLUX

E = high-tension kilovolts.
T = high-tension turns in series.
B = flux density in core (kilo-lines per square inch).
φ = total flux in core, in megalines.
s = current density in copper (kilo-amperes per square inch).

I = high-tension current at rated kva.

The proportions to be determined are:

$$c/a = X,\ h/2b = Y,\ A_i/A_o = Z.$$

From the general transformer equations,

kva. $= EI$,

$E = 4.44Tf\varphi 10^{-5}$,

$\varphi = BA_ik_i10^{-8}$,

$I = sA_ok_c/(2T10^{-3})$,

the following relations are obtained:

$$\text{kva.} = 2.22fBsk_ck_iA_oA_i10^{-5} \quad (1)$$

or

$$A_iA_o = P = \frac{\text{kva.} \times 10^5}{2.22 \times fBsk_ck_i} \quad (2)$$

If in a given transformer kva., E and f are known, B, s, k_c and k_i may be assumed, so that the product $P = A_iA_o$ is determined. B is usually fixed by permissible iron loss or exciting current, and s by the permissible copper loss or coil heating.

Method of Determining Theoretical Proportions

Type A.—Shell-Type Transformers with Rectangular Cores, Uniform Flux Density.

Case I. Design for Maximum Efficiency.

For maximum efficiency the total loss must be a minimum, or

$$V_iw_i + V_cw_c = \text{a minimum.} \quad (3)$$

From an inspection of Figs. 1 and 2 the volumes in terms of the dimensions become:

$$V_i = 4bhk_i(a + 2b + c),$$

or, taking out the corners,

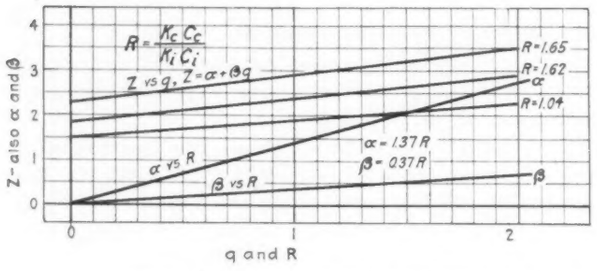
$$V_i = 4bhk_i(a + 0.83 \times 2b + c) \quad (4)$$

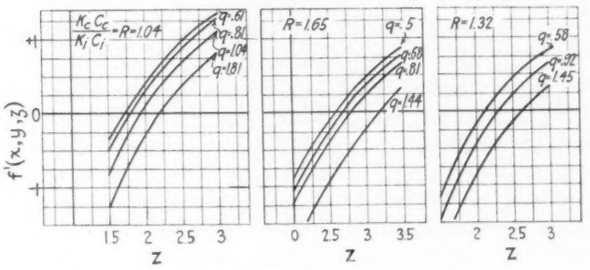
Likewise, the copper volume,

$$V_c = 2k_cac(h + 2b + \pi a/2 + 2d + e). \quad (5)$$

Expressing these volumes in terms of the ratios, X, Y and Z, since $A_iA_o = P$ and $A_i/A_o = Z$,

$$A_o = \sqrt{P/Z}, \quad (6)$$





FIGS. 4 AND 5—VARIOUS RELATIONS FOR SHELL-TYPE TRANSFORMER WITH UNIFORM CORE SECTION

and

$$A_i = \sqrt{P/Z}, \quad (7)$$

Also, since $ac = A_o$, and $c/a = X$, from (6) it follows that

$$a = (P/ZX^2)^{1/4} \text{ and } c = (PX^2/Z)^{1/4}. \quad (8)$$

Since $2bh = A_i$, and $h/2b = Y$, from (7) it follows that

$$2b = (PZ/Y^2)^{1/4}, \text{ and } h = (PZY^2)^{1/4}. \quad (9)$$

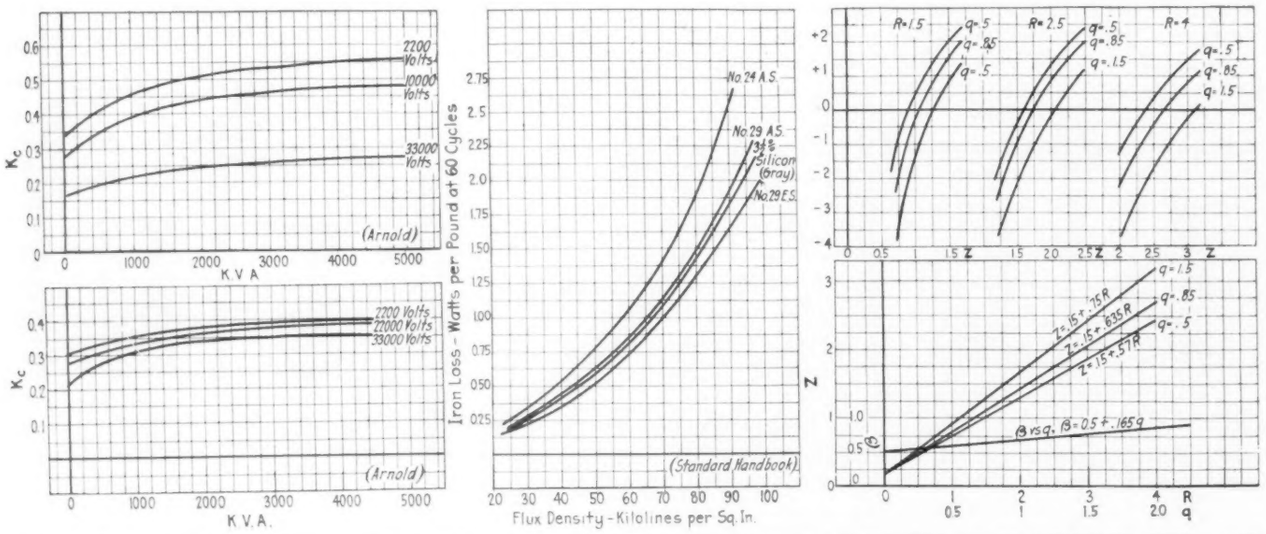
Rewriting equation (4),

$$V_i = 2k_i(PZ/Y^2)^{1/4} \times (PZY^2)^{1/4}\,[(P/ZX^2)^{1/4} + 0.83(PZ/Y^2)^{1/4} + (PX^2/Z)^{1/4}]$$

$$= 2k_i\sqrt{PZ}\,[(P/ZX^2)^{1/4} + 0.83\,(PZ/Y^2)^{1/4} + (PX^2/Z)^{1/4}]. \quad (10)$$

Rewriting equation (5),

$$V_c = 2k_c\sqrt{P/Z}\,[(PZY^2)^{1/4} + \frac{\pi}{2}(P/ZX^2)^{1/4} + (PZ/Y^2)^{1/4} + 2d + e)\,]. \quad (11)$$



FIGS. 6, 7, 8 AND 9—SPACE FACTORS FOR SHELL AND CORE TYPE TRANSFORMERS; PROPERTIES OF TRANSFORMER STEEL, AND SOLUTION FOR Z IN SHELL-TYPE TRANSFORMER WITH NON-UNIFORM FLUX

Substituting from equations (10) and (11) into equation (3), the loss in the transformer, in terms of X, Y and Z, etc., becomes

$$\text{Loss} = 2w_ik_i\sqrt{PZ}\,[(P/ZX^2)^{1/4} + 0.83(PZ/Y^2)^{1/4} + (PX^2/Z)^{1/4}] + 2w_ck_c\sqrt{P/Z}\,[(PZY^2)^{1/4}$$

$$+ (PZ/Y^2)^{1/4}) + \frac{\pi}{2}(P/ZX^2)^{1/4} + 2d + e]. \qquad (12)$$

To determine when this loss is a minimum, partial derivatives of equation (12) with respect to X, Y and Z are taken and equated to zero, as follows:

$$\frac{\delta\ (\text{loss})}{\delta X} = 2k_i w_i \sqrt{PZ}\left[\left(\frac{P}{Z}\right)^{1/4}\left(-\frac{1}{2}\right)X^{-3/2} + \left(\frac{P}{Z}\right)^{1/4}\left(\frac{1}{2}\right)X^{-1/2}\right] + 2k_c w_c \sqrt{\frac{P}{Z}}\left[\frac{\pi}{2}\left(\frac{P}{Z}\right)^{1/4}\left(-\frac{1}{2}\right)X^{-3/2}\right] = 0. \qquad (13)$$

Dividing by $\sqrt{P}(P/Z)^{1/4}$, $1/\sqrt{X}$, $1/Z$, to simplify, and solving for X,

$$X = 1 + \frac{\pi}{2}\left(\frac{k_c w_c}{k_i w_i}\right)\frac{1}{Z} = 1 + \frac{\pi}{2} \times \frac{R'}{Z}, \qquad (14)$$

the ratio factor, $k_c w_c/(k_i w_i)$, being replaced by R'. Taking the partial derivative of the loss with respect to Y and equating to zero, and simplifying,

$$Y = 1 + 0.83\, Z/R'. \qquad (15)$$

Taking the partial derivative of the loss with respect

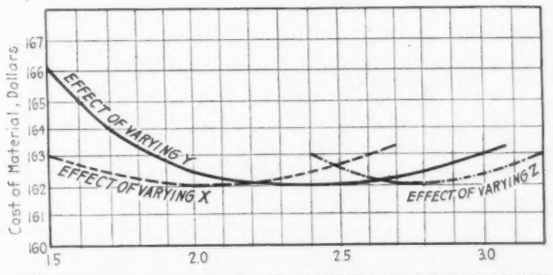


FIG. 10—VARIATION OF COST OF MATERIALS WITH CHANGE OF PROPORTIONS FOR A SHELL-TYPE TRANSFORMER HAVING UNIFORM CORE DENSITY

to Z, equating to zero and simplifying as far as seems possible, the somewhat awkward expression remains that

$$\frac{1+X}{\sqrt{X}} + 2.5\sqrt{Z/Y} - R'\left(\frac{1+Y}{\sqrt{YZ}} + q\frac{(Z)^{1/4}}{Z} + \frac{3\pi}{2\sqrt{XZ}}\right) = 0. \qquad (16)$$

In the latter equation q has replaced the expression

$$\frac{2(2d+e)}{(P)^{1/4}}$$

Equation (16) is probably best solved by assuming various values of Z, for several fixed values of q and $R'(= k_c w_c/k_i w_i)$, then solving for corresponding values of X and Y, and evaluating (16). The values of this function, when plotted against Z, form a curve passing through zero, thus giving the value of Z which satisfies the equation. As the solution is identical with that of Case II (minimum cost), it will be given in detail after Case II has been developed.

Case II. Proportions for Minimum Cost.

For the total cost of material to be a minimum

$$V_i C_i + V_c C_c = \text{a minimum}. \qquad (17)$$

Equation (17) is identical with (3) except that the constants C_i and C_c replace the constants w_i and w_c respectively, so that the solution will give the same final equations as Case I with the exception noted.

Therefore, for minimum cost of material,

$$X = 1 + \pi/2 \times R/Z, \qquad (18)$$

$$Y = 1 + 0.83\, Z/R, \qquad (19)$$

and

$$\frac{1+X}{\sqrt{X}} + 2.5\sqrt{\frac{Z}{Y}} - R\left(\frac{1+Y}{\sqrt{YZ}} + \frac{3\pi}{2\sqrt{XZ}} + q\frac{(Z)^{1/4}}{Z}\right) = 0, \qquad (20)$$

where

$$R = \frac{k_c C_c}{k_i C_i}, \text{ and } q = \frac{2(2d+e)}{(P)^{1/4}}$$

As stated above, the values of Z satisfying equation (20) are determined by assuming various values of Z, for various values of q and R corresponding to usual designs, substituting in (20) and noting the crossing of the axis. This is shown in Fig. 4. The values of Z resulting are then plotted against q for each of the values of R and are found to lie on straight lines of the form,

$$Z = \alpha + \beta q. \quad \text{(See Fig. 4.)} \qquad (21)$$

Likewise the values of α and β are plotted against R and two straight lines through the origin result, such that

$$\alpha = 1.37R, \qquad (22)$$

and

$$\beta = 0.37R, \qquad (23)$$

and so that the equation for the unknown Z becomes

$$Z = 1.37R + 0.37Rq. \qquad (25)$$

Equation (25) is perfectly general for shell-type transformers having rectangular core sections and uniform flux density, no matter what the voltage, frequency or type of service. These latter specifications will modify the factors k_c, k_i, C_c, C_i, q and P, but not the general expressions for X, Y and Z.

The application of the method previously outlined will be apparent from the following examples:

It is required to design a 75-kva., 60-cycle, 2200/110-volt shell-type transformer for distributing service.

Assumptions:

$B = 60$ kl./sq. in. in all sections.
$s = 1.3$ kiloamp./sq. in.
$k_c = 0.35$ (see Fig. 6). $k_i = 0.85$.
$d = 1.25$ in. $e = 0$.
$C_c/C_i = 4$. (For example, $C_c = \$0.14$ and $C_i = \$0.035$.)

From equation (2)

$$P = A_i A_o = \frac{75 \times 10^3}{2.22 \times 60 \times 60 \times 1.3 \times 0.35 \times 0.85} = 2425,$$

$$q = \frac{5}{\sqrt[4]{2425}} = 0.7, \quad R = \frac{0.35 \times 4}{0.85} = 1.65.$$

From equations (25), (18) and (19),

$$Z = 1.65(1.37 + 0.37 \times 0.7) = 2.7.$$

$$X = 1 + 1.57 \times \frac{1.65}{2.7} = 1.97 = 2.0.$$

$$Y = 1 + 0.83 \times \frac{2.7}{1.65} = 2.35, \text{ say } 2.4.$$

Therefore, the dimensions will be:

$$A_o = \sqrt{\frac{2425}{2.7}} = 30 \text{ sq. in.} \quad A_i = 2425/30 = 81 \text{ sq. in.}$$

$$a = \sqrt{30/2} = 3.87 \text{ in.} \quad c = 30/3.87 = 7.75 \text{ in.}$$

$$2b = \sqrt{81/2.4} = 5.75 \text{ in.} \quad h = 81/5.75 = 14 \text{ in.}$$

Volume of iron:

$$V_i = 2 \times 81 \times 0.85(3.87 + 0.83 \times 5.75 + 7.75)$$
$$= 2250 \text{ cu. in.}$$

$$\text{Weight} = 2250 \times 0.28 = 630 \text{ lb.}$$

Cost of core (approximately) $= 2250 \times \$0.035 = \$78.8$.

Iron loss:

For $B = 60$ kl. the loss per pound of iron is 0.75 watt (see curve, Fig. 8, for No. 29 E. S.).

Iron loss is then $F = 630 \times 0.75 = 475$ watts.

Volume of copper:

From equation (5)

$$V_c = 2 \times 0.35 \times 30(14 + 5.75 + 1.57 \times 3.87 + 2.5)$$
$$= 595 \text{ cu. in.}$$

Weight of copper $= 595 \times 0.32 = 190$ lb.

Approximate cost of coils:

$$\text{Cost} = 595 \times 0.14 = \$83.3.$$

Copper loss $= 0.81 \times s^2 V_c = 0.81 \times 1.3^2 \times 595 = 810$ watts.

Total cost $= \$78.8 \times \$83.3 = \$162.1$.

Total loss at full load:

$$\text{Loss} = 475 + 810 = 1285 \text{ watts.}$$

Efficiency at full non-inductive load:

$$\text{Per cent loss} = \frac{1285 \times 100}{75{,}000 + 1285} = 1.69.$$

$$\text{Efficiency} = 98.31 \text{ per cent.}$$

Efficiency at half load:

$$\text{Per cent loss} = \frac{(475 + 202) \times 100}{37{,}500 + 677} = 1.77.$$

$$\text{Efficiency} = 98.23 \text{ per cent.}$$

As a test of the theoretically determined values of X, Y and Z, several designs are worked out and the results tabulated herewith. Curves of the cost of material are also plotted against the variables X, Y and Z in Fig. 10.

DESIGN FIGURES, VARYING ONE OR MORE PROPORTIONS

No.	X	Y	Z	Ao	Ai	a	$2b$	c	h	Vi	Vc	Cost (Dollars)		
												Core	Coils	Total
1	2	2.4	2.7	30	81	3.87	5.75	7.75	14	2250	595	78.8	83.3	162.1
2	2	2.4	2.4	32	76.2	4.0	5.63	8.0	13.5	2160	625	75.6	87.5	163.1
3	2	2.4	3.0	28.5	85	3.75	5.96	7.5	14.3	2350	570	82.5	79.8	162.3
4	2	2.4	3.2	27.5	88.2	3.7	6.1	7.4	14.6	2420	558	84.8	78.2	163
5	1.5	2.4	2.7	30	81	4.47	5.75	6.7	14	2190	615	76.8	86.1	162.9
6	2.5	2.4	2.7	30	81	3.46	5.75	8.65	14	2320	582	81.3	81.5	162.8
7	2	1.5	2.7	30	81	3.87	7.35	7.75	11	2480	566	86.9	79.2	166.1
8	2	3.0	2.7	30	81	3.87	5.19	7.75	15.6	2190	617	76.7	86.3	163
9	2	1.9	2.7	30	81	3.87	6.52	7.75	12.4	2340	578	82.1	80.8	162.9
10*	1.56	2.36	1.76	37.1	65.2	4.87	5.25	7.6	12.4	1865	722	65.5	101	166.3

*The proportions used in this example are those of a transformer of similar specifications shown on page 348 of Arnold's "Wechselstromtechnik," Vol. II.

It should be noted that the maximum increase above the minimum cost is only $4.20, or about 2.6 per cent. Therefore there is a wide range over which the proportions of this type of transformer may be varied without greatly increasing the cost of material.

Case III. For an Assumed Ratio of Iron and Copper Losses, to Determine the Dimensions Giving Minimum Cost of Material.

The solution for this case is identical with that of Case II, except that the product Bs is to be assumed rather than the separate values. Then, having determined all principal dimensions, as in Case II, the values of B and s are adjusted as follows. If it is desired that iron loss $= p \times$ copper loss, where p is the proportionality factor, then (approximately)

$$mB^2 V_i = pns^2 V_c, \qquad (26)$$

where m is a constant obtained from the core-loss curve of the iron and n is the specific resistance of the copper. For example, using the No. 29 E. S. steel at 60 cycles, $m = 0.58 \times 10^{-4}$, while $n = 0.82$ at 70 deg. C., so that equation (26) becomes

$$0.58 \times B^2 V_i = 0.82\, ps^2 V_c \times 10^4.$$

In general

$$B = s\sqrt{npV_c/mV_i}; \qquad (27)$$

but the product, $P' = Bs$ has been assumed, therefore

$$B = \sqrt{P'} \times \left(\frac{npV_c}{mV_i}\right)^{1/4} \qquad (28)$$

Example.—Suppose that in the example of Case II it had been desired that the relation of iron loss to copper loss, or p, had been 0.5. By assumption $Bs = 60 \times 1.3 = 78$, therefore

$$B = \sqrt{78}\left(\frac{0.82 \times 10^4 \times 0.5 \times 595}{0.58 \times 2250}\right)^{1/4} = 58.2, \text{ and } s = 1.34.$$

Type B.—Transformers of the Shell Type with Non-uniform Flux Densities.

With the relative core widths shown in Fig. 3, the volume of iron in the core (ignoring corners) is

$$V_i = 2k_i[(b + 1.5b)(c + 4b) + 4ab]h$$
$$= 2k_i A_i(2a + 5b + 1.25c).$$

Allowing for corners removed,

$$V_i = 2k_i A_i(2a + 4b + 1.25c). \qquad (29)$$

As before, the volume of copper is

$$V_c = 2k_c A_o(h + 2b + 1.57a + 2d + e).$$

Total cost of material will be

$$\text{Cost} = V_i C_i + V_c C_c$$
$$= 2k_i C_i A_i[2a + 4b + 1.25c] + 2k_c C_c A_o$$
$$[h + 2b + 1.57a + 2d + e].$$

This is to be a minimum. Expressing the dimensions in terms of P, X, Y and Z,

$$\text{Cost} = 2k_i C_i \sqrt{PZ}\left[2\left(\frac{P}{ZX^2}\right)^{1/4} + 2.0\left(\frac{PZ}{Y^2}\right)^{1/4} + 1.25\left(\frac{PX^2}{Z}\right)^{1/4}\right]$$
$$+ 2k_c C_c \sqrt{\frac{P}{Z}}\left[(PZY^2)^{1/4} + \left(\frac{PZ}{Y^2}\right)^{1/4} + \frac{\pi}{2}\left(\frac{P}{ZX^2}\right)^{1/4} + 2d + e\right]$$

To make this value a minimum, partial derivatives are taken and equated to zero, giving

$$X = 1.6(1 + \pi R/4Z), \qquad (30)$$

$$Y = 1 + 2.0\, Z/R, \qquad (31)$$

and

$$\frac{2 + 1.25X}{\sqrt{X}} + 6.0\sqrt{\frac{Z}{Y}} - R\left[\frac{1 + Y}{\sqrt{YZ}} + \frac{3\pi}{2\sqrt{XZ}} + q\,\frac{(Z)^{1/4}}{Z}\right] = 0. \qquad (32)$$

Equation (32) was solved for Z as in Case II, for various values of R and q, and the Z so determined was plotted in Fig. 9 against R and found to be a straight line passing through the point $Z = 0.15$. Thus the curves of Z versus R could be represented by the equation

$$Z = 0.15 + \beta R.$$

Again plotting values of β against q, it was found that

$$\beta = 0.5 + 0.165q,$$

so that

$$Z = 0.15 + R(0.5 + 0.165q). \qquad (33)$$

Example.—For the same specifications used in Type A the following design is obtained.

Assuming $B_{max} = 90$ kl./sq. in., and other quantities as before,

$$P = A_i A_o = \frac{75 \times 10^5}{2.22 \times 60 \times 90 \times 1.3 \times 0.85 \times 0.35} = 1620.$$

$$q = \frac{5}{(1620)^{1/4}} = 0.79.$$

Then

$$Z = 0.15 + 1.65(0.5 + 0.165 \times 0.79) = 1.19.$$

$$X = 1.6[1 + 0.785(1.65/1.19)] = 3.34.$$

$$Y = 1 + 2.0(1.19/1.65) = 2.5 \text{ (used 2.8)}.$$

Now

$$A_o = \sqrt{1620/1.19} = 36.9 \text{ sq. in.}$$

$$A_i = 1620/36.9 = 44 \text{ sq. in.}$$

$$a = \sqrt{36.9/3.34} = 3.32 \text{ in.}$$

$$c = 36.9/3.32 = 11.1 \text{ in.}$$

$$2b = \sqrt{44/2.8} = 3.96 \text{ in.}$$

$$h = 44/3.96 = 11.1 \text{ in.}$$

Therefore,

Volume of iron (allowing for corners), $V_i = 1.7 \times 44(2 \times 3.32 + 2.0 \times 3.96 + 1.25 \times 11.1) = 2130$ cu. in.

Cost of iron, $D_i = 2130 \times 0.035 = \$74.5$.

Iron loss, $W_i = 2130 \times 0.74 \times 0.28 = 440$ watts.

Volume of copper, $V_c = 0.7 \times 36.9(11.1 + 3.96 + 1.57 \times 3.32 + 2.5) = 588$ cu. in.

Cost of copper, $D_c = 588 \times \$0.14 = \$82.2$.

Copper loss, $W_c = 0.82 \times 1.3^2 \times 588 = 810$ watts.

Total cost of material = \$156.70. This shows a gain of some 3 per cent over the straight shell-type transformer.

In the second part of this paper the remaining types of transformers—namely, core type and multiple magnetic-circuit transformers—will be treated and a comparison will be made of the representative designs of various types.

New Conditions Affecting Rate of Return

Changes in the Money Market Due to the War and Great Demand for Capital, Together with Increases in Operating Cost, Justify Higher Rate of Return, Says James D. Mortimer

MR. MORTIMER ON CHANGING RATE OF RETURN

The facts justify a higher rate of return than in the past.

All interest rates are certain to be on a much higher level.

Even at high rates the amount of money that can be borrowed is limited.

The only method of finance now open is that of selling 7 per cent preferred stock to customers.

THE question of rate of return on public utility capital is bound up irretrievably with that of rate of return on other capital. That all interest rates are now on a higher level the current prices of bonds and stocks tell eloquently. Government and private borrowers alike have to pay more for money. How the necessary capital expenditures shall be financed is a problem for whose solution the public and public service commissions are as responsible as the public utility itself. Higher cost of money, like the higher cost of materials and labor, points to higher rates to consumers.

In connection with a recent hearing before the Missouri Public Service Commission, James D. Mortimer, as president of the Union Electric Light & Power Company of St. Louis, gave careful attention to the increasing importance of the rate of return under present changing conditions. The case at issue was brought some years ago by the Engineers' Incitation Club, alleging discriminatory rates and excessive profits by the Electric Company of Missouri in the handling of power from the Keokuk hydroelectric development. An appraisal has been made. The company petitioned that the case be dismissed. No objection was made by counsel for the plaintiff to this petition, but the commission declined to take this action without giving specific reasons for its decision, and the case has gone through the usual course.

Mr. Mortimer said that in the recent past electric light and power utilities have been regarded as among the best public utility investments. They have made a strong appeal to the various classes of investors. There seem to be three principal classes of such investors who have provided the money for the expansion of public utilities. There is the investor who is satisfied with a rate of return running in normal times from 5 per cent to 5¾ per cent and who wishes such return evidenced by a contract; he purchases bonds. There is the investor who desires a higher return, who wishes that the return shall commence immediately, and who is willing to purchase stock and wishes the return fairly well assured; he purchases a preferred stock. There is, finally, the investor who is willing to forego any actual return during the first few years, but who expects his return to be much larger than the other two investors require, and who expects an appreciation in market value of his investment; such an investor purchases common stock.

When regulatory commissions some years ago an-

nounced that capital invested in public utilities was entitled to 7½ per cent to 8 per cent per annum after providing for all ordinary operating expenses and a proper allowance for future replacements, said Mr. Mortimer, it tended to give stability to public utility investments and the market for public utility securities rapidly expanded and strengthened. Because there were some more or less indefinite factors connected with the question of a return of 7½ per cent to 8 per cent, it was not entirely clear upon what basis this return was to be computed, but it was quite properly assumed that the new capital would be entitled to these rates of return. The elements of value making up the measure of utility capital were not very well defined, although the early decisions of regulating commissions made it pretty clear that there would be added to the reproduction cost of the physical property a proper allowance for working assets and going value. The United States Supreme Court had held that all these elements were entitled to consideration and that a going property was worth more than the bare physical bones of plant. It was also quite properly assumed that the regulating commissions would make an adequate allowance in the cost of production of service for future replacements of physical property.

NOT A COMPLETE MONOPOLY

In arriving at a return of 7½ per cent to 8 per cent, it was reasoned that the bare interest cost of money was 6 per cent and that 1½ to 2 per cent in addition should be allowed for profit. This return would probably have been sufficient in normal times for a utility enjoying a monopoly in a large city and with the equivalent of a guarantee that such return would be continued during both good and poor industrial conditions. Unfortunately, Mr. Mortimer added, no public utility enjoys a complete monopoly because there is always competition. An electric utility must compete with the gas utility and the private power plant. In St. Louis the Union company, in addition to these sources of competition, encounters competition from two other concerns and passes completely out of the class of a monopoly.

Mr. Mortimer then showed that the recent rise in the cost of labor and materials has increased operating expenses at a rate much faster than any possible economies resulting from increased volume, density or higher load factor. These increases in costs have made returns unstable, and the immediate future of the public utility business has been far from bright. To the utilities the purchasing power of money has decreased; their selling prices have been fixed, and they cannot procure increased returns except with the approval of the regulating commission. This lack of stability in return and hesitancy on the part of some commissions to authorize badly needed increases in rates have made public utility investments far less attractive, and they have largely passed out, for the time being, from the conservative class. The inflation in values resulting from the enormous government borrowings is certain to remain with us during the continuation of the war and is likely to continue for some years after the war's termination.

The deduction which Mr. Mortimer draws is that these facts now place the junior securities of public utility corporations in the semi-hazardous class and justify the payment of a higher rate of return than has been the custom in the past. All interest rates are certain to attain and maintain themselves on a much higher level than during the period preceding the outbreak of the war. Permanent financing of public utility corporations is not possible at this time. Temporary financing by the sale of short-term notes secured by bonds in ample margin was possible up to a month or so ago, but the interest rate cost to the issuing company was 8 per cent or more. Thus new money cost a higher rate than the utilities were earning. But even then the amount of money that could be borrowed was very limited compared with the cost of the additions to physical property.

There is now no market for short-term bond-secured notes even at these high interest yields. The only method of finance now open is that at present being pursued by the Union company in selling 7 per cent preferred stock to customers. The amount of money that can be obtained from this source is presumably limited. Mr. Mortimer added:

"A return of 10 per cent or 12 per cent would not be too high for public utilities during these times. Even these rates would not likely attract any very large sum into the business during the continuation of the war, although they might be regarded as reasonable after the war's termination. The point that I wish to make clear and to emphasize is that pre-war standards are useless in estimating reasonable rates of return for public utility investments because the whole plane of interest rates and security yields has been very much elevated.

GOVERNMENT AID MAY BE REQUIRED

"The whole level of utility charges will have to be raised if the public utility business is not to be struck a blow from which it can never recover. Even then it is doubtful if public utilities can at present secure the capital they require for expansion. Government aid may be required in some cases where the continued growth of the utility is necessary to provide service for government purposes.

"In the long run, the utility jointly with the regulating commission should endeavor so to adjust rates that the actual rate of return earned on the utility capital will neither be higher nor lower than the cost of money to the utility. This we believe is the equitable viewpoint. It will assure the lowest rates consistent with fair cost and prevent speculation in securities of public utility corporations.

"The ideal system of ownership is that where each customer has a proprietary interest in the utility in proportion to the service rendered him. This we are endeavoring to formulate through our movement to sell stock to customers. We believe in the eventual mutual ownership of public utilities as the best from the standpoint of the customers and from every social and economic view. Such a movement if carried to the possible limit would greatly promote community and individual thrift and prevent public utilities from serving as a bone of contention in politics. There would then be no demand for ownership by the municipality, and the problems of regulation would comprise only those of seeing that the charges for services were equitably distributed as between the different classes of customers."

Use of Electricity in the European War

Transmission Lines Indispensable in Territories Occupied by the Armies — High-Tension Lines in France to Remain After the War and Help in Restoration —Lessening the Effect of Coal Shortage

BY CAPT. GUSTAVE P. CAPART*

IT IS not intended in this article to deal with the rôle played by electricity in the munition plants, but only with the industrial uses to which it has been put within the army zone. Charlemagne while waging his wars made roads. In the great war now being

FIG. 1—TRANSMISSION LINE IN REAR OF FIGHTING ZONE

waged we have made not only roads and railroads, but also conveyors of energy. To-day it is indispensable to build electric lines in territories held by the armies.

We will sum up in a few lines the rôle of electricity in the zone behind the troops, then we shall see what its rôle is in the zone near the firing line. In the first case the organization of the electrical service of the army is concerned; in the second case the organization within the individual army division which is the unit of combat. These are two distinct organizations which must not be confounded. One may be considered as a territorial organization resembling that of peace times, the other as a provisional organization of a temporary character.

ELECTRIC ORGANIZATION OF THE ARMY

The object of the electric organization of the army is to distribute light and motive power as near as possible to the firing line by applying the established methods of the industry. Electric lighting of a general nature is the thing which next to nourishment contributes the most to maintain the morale of the men. Moreover, the use of electrical energy in the territory occupied by the armies increases the product of manual labor in multiple forms, a consideration not negligible in a war of attrition such as that we are waging.

From the electric central stations behind the front high-tension lines which form part of the network of peace times radiate. The military lines are connected with the public network and are designed so that they may be extended in the case of an eventual retreat by the enemy, and so that they will in their turn form part of the network of peace times in the day when hostilities shall be terminated. The armies, in addition to the fighting units, are composed of great supporting bodies in the rear which all make large use of electricity. The staff headquarters, the photographic and cartographic services, the hospitals, the magazines of munitions and the road service for transporting them, the aerial carriers, the forest service supplying the sawmills, the repair shops for the automobile service, the lighting of the aviation hangars and of the fields used by the bombarding escadrilles that operate at night, all depend on the great distribution system operated as it would be in times of peace.

The high-tension lines are erected by gangs of mili-

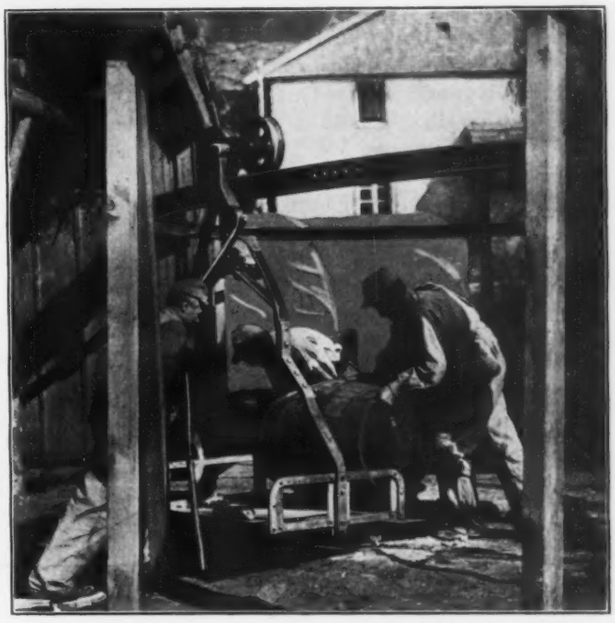


FIG. 2—LOADING AN ELECTRICALLY PROPELLED WAGON

tary electrical workers under the command of an engineer officer. The companies of electricians belonging to the army install the interior equipment and make the connections with the general system. By proceeding in this way a great economy of effort and men is

*Captain Capart is a member of the general staff of General Pétain and is now in the United States as a member of the French scientific commission.

effected. The little outfits of electrical apparatus utilized at the beginning of the war are now at the front, as will be told later, in regions where the artillery fire of the enemy will not permit the maintenance of high-tension aerial lines.

The high-tension lines in the zone occupied by the armies must be constructed in accordance with all the rules of the art. These lines should, indeed, remain in existence after the war. They pass beside ruined towns which must be made to arise from their ashes, and the lines must contribute to the resuscitation of these dead places and the resumption of their industrial life. At the present moment France is pushing the development of means to carry electrical energy into the army zone in order to lessen the effects of the shortage of coal and of cars. The centralization of the consumption of fuel will lead to a marked economy.

ELECTRIC ORGANIZATION AT THE FRONT

In the front lines of the army the utilization of electrical energy is above all demanded for the illumination of the shelters and of the tunnels which connect the first positions with the second. For these purposes electrical outfits of very feeble power are used, the network never being extended far because of the danger of the cables being broken by the bombardment. Another purpose for which electricity is employed at the front is in the laying of mines, where it is useful in ventilation, lighting, boring, removing earth, operating compressors, etc. Some very important installations of this kind have been made on the German side as well as on the French.

At the end of 1915 we had installed a complete plant for distributing energy in the Hauts de Meuse at one of the most unhealthy situations on the front. A 1500-volt substation was established at 80 m. (262 ft.) from the first line, which bordered a series of immense mining tunnels. Many of the cables had to be carried across a ravine. This work was not accomplished without danger because many times a day the cables were cut by the explosion of projectiles and repairs had to be made under fire.

On April 17 last, at the moment of the attack upon Mont-sans-Nom in Champagne, the Sixth Zouaves, reaching the summit of the position, took possession of a kind of shelter lighted by a little electric plant of 20 hp. installed 10 m. (32.8 ft.) under ground. Less than an hour after this position was taken the electrical workers of the Fourth Army had the Boches' electric installation working to aid the French.

The Italian army also makes a very large use of electricity at the front. Besides the applications already mentioned, its electrical organizations have installed numerous plants to aid in supplying the mountain batteries with munitions.

I could multiply such examples infinitely, but this short account is sufficient to show the importance of the creation of an electric service in the zone of the armies. Better than any other country the United States can effect an organization of this character. American electrical workers will be able to do in France a work equal to that of their colleagues in the regiments of railroad men. They will at the same time serve as pioneers of the American electrical industry in France and will prepare with their French comrades the economic war of to-morrow against the Central Empires.

ELECTRIC SERVICE AT CAMP JACKSON, S. C.

Columbia Railway, Gas & Electric Company Provides Service Quickly for the Army Cantonment Near Its System

Service for the army cantonment at Columbia, S. C., is being furnished by the Columbia Railway, Gas & Electric Company. Alfred Lewis Kenyon, general manager of that company, has given the following particulars to the ELECTRICAL WORLD:

The contract for electric service for the army cantonment at Columbia, S. C., was applied for on July 27. Work was immediately started on the six-mile (9.6-km.), 13,000-volt, three-phase transmission line from the city limits to the camp. Service was rendered on Aug. 10. The installation consists of six 250-kw., 13,000-volt transformers. Distribution is standard, 2300 volts primary, 110 volts secondary, three wires. About 900 kw. will be used for lighting and 700 hp. for motors, of which 200 hp. will be used for pumping water, the rest being used for laundry, bakery and other motive power.

Service is supplied from the Columbia Railway, Gas & Electric Company's general 25,000-hp. transmission system, operated from Parr Shoals on the Broad River, 28 miles (4.5 km.) from Columbia, at 66,000 volts. At Columbia a second hydraulic installation on the Congaree River supplies 10,000 hp., and a steam reserve plant of 8000 hp. is also ready for instant service in case of need.

Prompt delivery of transformers was secured through assistance of the War Department.

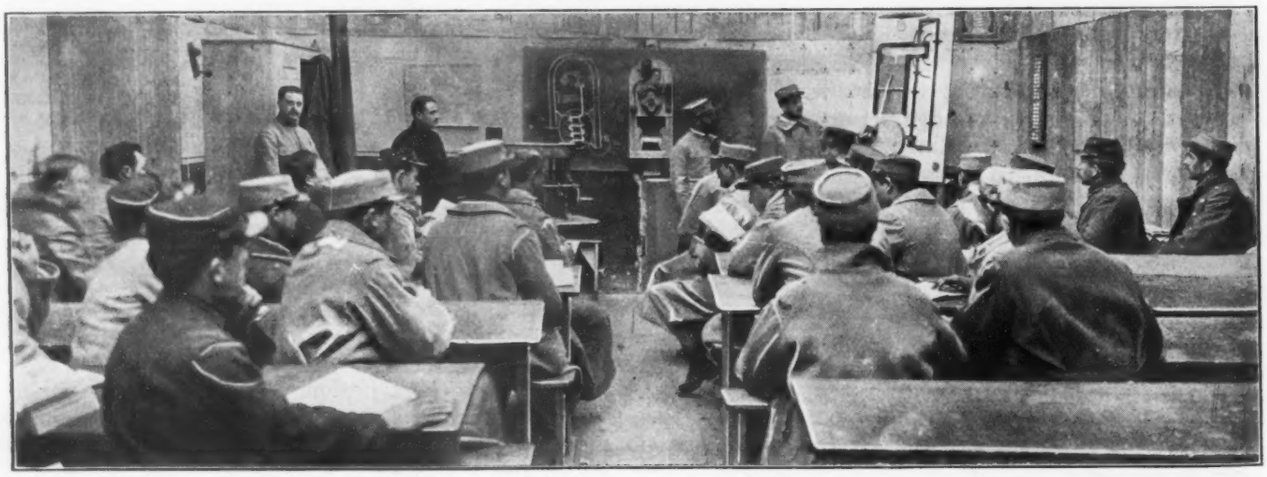


FIG. 3—TEACHING SOLDIERS ELECTRICAL DUTIES AT LYONS SCHOOL

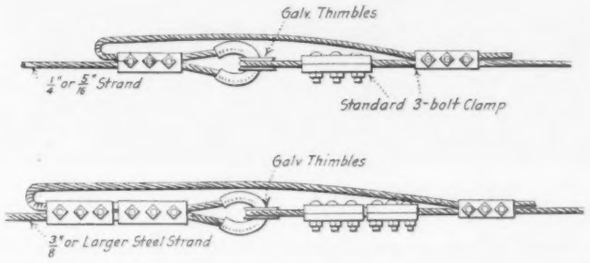
STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

A METHOD OF SPLICING STRANDED-STEEL CONDUCTORS

Western Company Uses Splices Made Up with Standard Three-Bolt Guy Clamps—Construction Avoids Heating at Joint

The use of stranded steel conductors for high-voltage distribution lines has necessitated modifications in many details of construction which have in the past been standardized in construction employing copper. The



STRANDED-CONDUCTOR SPLICE THAT DOES NOT RUN HOT

familiar Western Union soldered splice or the solderless sleeve splice is not advisable for steel conductors, particularly where, by installing long spans, advantage is taken of the high tensile strength of the steel. The soldered splice lacks strength, and the twisted sleeve splice is subject to corrosion.

To obviate this difficulty, one California company utilizes splices made up with standard three-bolt guy clamps. As will be seen in the accompanying illustration, three clamps are required for a splice in a ¼-in. (6.4-cm.) or 5/16-in. (7.9-cm.) conductor, and five in a ⅜-in. (9.5-cm.) conductor. In each case it will be noted that the clamp which provides the electrical contact between the two cables is subject to no mechanical stress. Since both clamps and conductors are double-galvanized, no corrosion is to be expected. Experiments have shown that this form of splice when properly made up is as strong mechanically as the cable itself, and there is no tendency of the splice to run hot owing to lack of conductivity.

IMPORTANCE OF KEEPING BOILER TUBES CLEAN

Reasons Why Mechanical Cleaning Is Much Simpler, Safer and More Efficient than the Hand Method

BY ALBERT MARTINEAU

In these days when coal is so scarce and of such unprecedentedly high intrinsic value every pound used to better advantage is a victory for economy that should not be overlooked. Yet many tons of coal are being wasted daily just because the boiler heating surfaces are prevented from absorbing all the heat they might because of soot and ash that have clinkered and fused and become incrusted upon them. If every central station manager, large and small, were to keep a close watch on a thermometer in the stack, comparing the temperature of the flue gases before and after a thorough cleaning of the boiler heating surfaces, it would not be long before keeping them clean would be made as important a task of the boiler-room force as making steam. It is not uncommon to reduce the temperature of the flue gases 150 deg. by cleaning. Moreover, a close examination of the soot removed from boiler tubes is a good indication of whether combustion is being obtained efficiently and whether firing is being carefully done.

Apart from the ever-present need for using all the heat obtained, it is possible that many users are now burning different coal from that they used a few months ago, making it perhaps necessary to clean boiler tubes oftener than was the case previously. The rapidity with which soot and ash and clinker incrustations form—and their formation is cumulative in effect—depends very largely upon the coal—anthracite or bituminous or semi-bituminous—and the rate of evaporation as affected by "forcing."

Two factors that require consideration in maintaining boiler heating surfaces in efficient heat-absorbing condition are how often they should be cleaned and how thoroughly this should be done. The next questions are how these requirements may be met with maximum effectiveness, greatest safety, the minimum of time, and preferably the minimum of expense. If the soot and powder-like ash are removed soon after their deposit, the accumulation of more material, which becomes a hard, tenacious mass and which requires strenuous methods of removal, can be delayed although not entirely prevented. The question then becomes whether to employ hand or mechanical cleaning.

Blowing out the soot and ash by a hand hose under live steam or compressed air is the oldest method. It is a job the value of which depends upon the amount of care exercised by the worker as to how efficiently the heating surfaces are cleaned. Perhaps there is no better way of ascertaining how thorough such work has been than to use a flashlight.

Hand blowing, justified on small boilers, assumes a very different aspect with large units. The length of tubes is greater, making them more difficult to reach and clean by hand. Many more tubes are used, making it a simple matter to miss some. In any case hand blowing always takes much more time to accomplish than mechanical blowing. Frequent cleaning necessitates opening the hand-holes provided for blowing, thus giving ample opportunity for cracks and leaks to be left after closing through haste or carelessness. The result is that air infiltration is very likely to occur, interfering with combustion efficiencies by causing a low per-

centage of CO_2. A marked drop in the percentage of CO_2 and also of flue-gas temperatures after the hand blowing of a boiler, while indicating that the heating surfaces are cleaner, may also indicate that air infiltration exists.

In hand blowing the question arises whether to use live steam or air, and if air whether it should be by the pressure or vacuum system. The use of steam is dangerous but often convenient, air not being always available whereas steam is. Many extremely painful injuries are suffered owing to the use of steam, while compressed air also causes trouble by blowing grit and ash into the eyes. The vacuum system is the safer, though many assert that compressed air gives more efficient results.

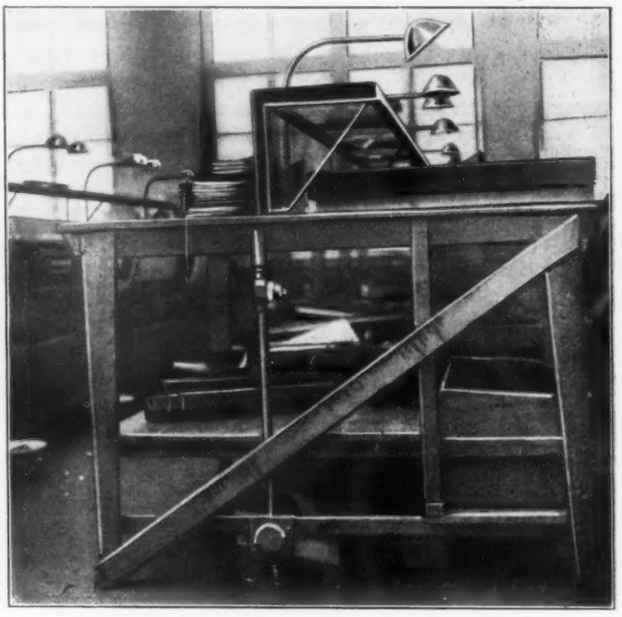
Some companies continue old and unsafe methods because they do not appreciate the wasteful expense and risk of doing so. Many others believe that the initial cost and maintenance charges of mechanical cleaning are not justified because the saving in fuel shows such a small balance in favor of mechanical cleaning. Safety, the shorter time required to clean, the reduction of air infiltration, the ability to keep a boiler in service longer, the cost of banked fires for hand blowing, these are some of the factors that should be included and placed to the credit of mechanical cleaning, although they are items not readily evaluated in dollars and cents.

The mechanical soot cleaner does not take the place of the wire brush and scraper for periodic use, but it mechanically blows out the soot and ash before they accumulate to fuse and form incrustations, interfering with the heat transfer and the draft up the stack. The mechanical cleaner enables a boiler to be cleaned several times during the day, which is not usually feasible with hand cleaning. This necessarily means cleaner surfaces, more efficient utilization of the furnace gases and the maintenance of greater steam-making capacities at all times instead of rapid reduction. Mechanical cleaning cleans all parts of the boiler, and at once, which is not possible with hand cleaning. Where the superheater is placed in the boiler it is often neglected, and this results in a decrease in superheat and in efficiency of the turbine unless some convenient means of cleaning is employed.

LIGHTING ARRANGEMENT FOR SHOE FACTORY CUTTING BENCH

Improved Lighting Scheme Used in a New England Shoe Factory—Obstruction to Work and Glare Avoided

In place of the suspended lamp cords and swinging units formerly used, with the disadvantage of obstruction to the work of a cutting bench at the shoe factory of Lunn & Sweet, Auburn, Me., the lighting installation shown herewith has been provided under the direction of the chief electrician, Ernest Bragdon. Brackets carrying two 40-watt lamps with an intermediate snap switch are carried over the table top and fitted with metal reflectors of Holophane type 55, which screen the workers from glare. The brackets are of pipe-conduit design and are provided at their lower ends with flanges through which they are screwed into the table. To plates on the under side of the table are fastened outlet boxes, the lead wires being run to taplet of pressed steel which receives a conduit riser running upward from a junction box near the floor as shown. Below the junction box, and thence through the floor to wiring on the ceiling of the floor below, the wiring is in BX



METHOD OF LIGHTING SHOE-CUTTING BENCH

conduit, which terminates in a fuse block on the ceiling and provides a most convenient and flexible arrangement in making the actual wiring installation.

OBTAINING FLEXIBILITY IN MOUNTING OF MOTORS

Method of Providing Clear Span Below Machine and Arrangement Necessary Where Driving Connection Is Close to Floor

Flexibility has always been a characteristic of the electric drive, and the installation of motors for both

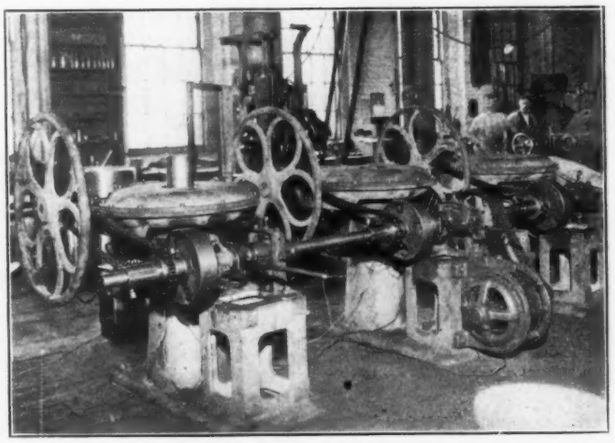


FIG. 1—MOTOR ATTACHED TO PEDESTAL OF ONE MACHINE AND DRIVING SEVERAL UNITS

group and individual machine operation offers many opportunities for convenient arrangement. In Fig. 1 the motor driving a machine group through silent-chain connection is attached to a vertical pedestal in such a manner as to leave the floor space below free for clean-

ing. A short, compact chain connection is provided, and ventilation conditions are better than with the motor on the floor. As the motor is of the induction type and designed for operation in the position shown, there is a saving in space and convenience in maintenance specially favorable in this installation. In Fig. 2 a motor driving a direct-connected machine unit is shown. In this case the machinery requires that the driving unit be set low with respect to the floor, and this has accordingly been cut away so that about 50 per cent of the motor is housed in the pit shown. The depressed space is easily cared for on the ceiling below by reinforced-concrete construction, and the pipe guard shown in the illustration protects employees from the pits.

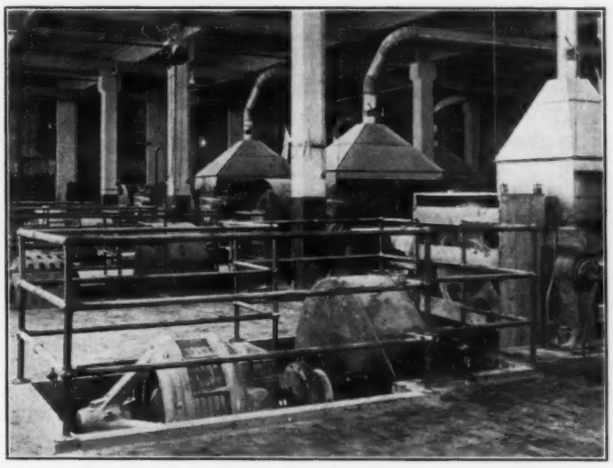


FIG. 2—MOTOR SET IN PIT TO ALLOW CONNECTION WITH MACHINE DRIVEN

A SIMPLE METHOD OF FINDING MOTOR LOAD

Watt-Hour Constant of Watt-Hour Meter Used to Determine Power Demand—Data for Various Kinds of Meters in Tabulated Form

The accompanying table is an enlargement of the one given in the Oct. 6 issue of the ELECTRICAL WORLD, page 671, for determining power demand by the use of the watt-hour constant of a watt-hour meter, as it includes three-wire and polyphase meters. The statement made in the former article that the multiplying factor for 440-volt service is four does not hold in all cases. The table was prepared by Willard S. Wilder of the meter and testing department of the Milwaukee (Wis.) Electric Railway & Light Company.

TESTING CONSTANTS FOR 110-VOLT, 60-CYCLE STANDARD WATT-HOUR METERS*

Make of Meter	Type of Meter	Capacity in Amperes							
		3	5	10	15	20	25	40	50
General Electric	J; J-1; JN; FN; D-1; DN	⅓	0.5	0.5	1.0	..	1.0	..	2
General Electric†	I; I-S; I-14	⅓	0.3	0.6	1.0	..	1.5	..	3
General Electric‡	C; C-5; C-6; C-9; J-2; D-2	⅛	0.2	0.4	0.6	..	1.0	..	2
Westinghouse‡	A; round	..	¼	½	..	⅔	..	⅔	..
Westinghouse‡	B; C; OA; D; C	..	½	⅔	1	⅓	⅔	⅔	1⅓
Fort Wayne§	K; K_1; K_2; K_3 (above serial No. 345,000)	..	0.25	0.5	0.75	1	1.25	2	2.5
Sangamo	F	..	½	⅔	..	⅔	..	⅔	..
Sangamo	D	..	⅔	⅔	..	⅔	..	⅔	..
Columbia‡	All	..	⅝	⅝	⅝	..	2⅝	..	2⅝
Duncan	All (under serial No. 150,000)	..	0.25	0.5	1	..	1	..	2

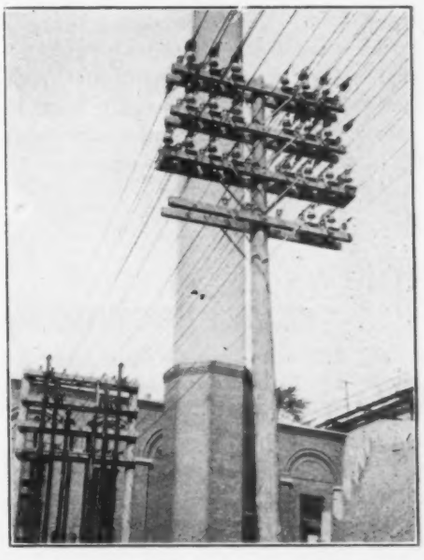
*For 220-volt meters double the constant.
†For polyphase meters double the constant.
‡For three-wire and polyphase meters double the constant.
§For three-wire meters double the constant; for polyphase meters multiply the constant by four, except type K_3 polyphase meters, for which the constant is doubled.

HOW COMPANY MINIMIZES SERVICE INTERRUPTIONS

Liberal Use of Disconnecting Switches on Overhead Lines Assists in Localizing Trouble and in Maintaining Continuous Operation

The accompanying illustration shows four 2300-volt lighting and power circuits and the six 5000-volt arc circuits leaving the power house of the Crawfordsville (Ind.) Electric Light & Power Company through 200-amp. Delta-Star disconnecting switches. At various strategically selected points in the distribution system the lines have been "phased out" and similar switches have been installed to permit opening certain sections of line and feeding in from other directions. In this way provision has been made for localizing trouble and preventing serious service interruptions.

The method of installing the switches is shown in the picture. The conductors, instead of being cut straight through at the junction pole, are interrupted by two porcelain strain insulators fastened at the ends of a short piece of messenger wire. This messenger wire is then tied in on the glass insulators. Taps from the conductor running in each direction are then brought down to the terminals of the switch. Each switch itself is mounted on a 1-in. (2.54-cm.) piece of hard-wood board which is attached to the double cross-arm. The disconnecting switches were selected for this service on account of the fact that they can be safely and quickly operated. F. H. Miller, manager of the Crawfordsville company, said that this method of arranging for emergencies on distribution lines was especially valuable in case of danger from fire.



EACH CONDUCTOR LEAVING THE POWER HOUSE PASSES THROUGH A DISCONNECTING SWITCH ON THE JUNCTION POLE

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

SHORTENING THE TRIAL AND PAYMENT PERIODS

The Old Idea of Ten Days' Free Trial and Twenty-four Months to Pay Is Giving Way to Five Days and Eight Months

It is only a few years since the free-trial and deferred-payment plans were new in the electrical business. These selling ideas were taken up extensively by central stations and dealers at a time when even electric flatirons were hard to sell. There was a dearth of business in the land and, so everybody thought, it behooved the merchant to be liberal. Electrical merchants did as much as they could to extend easy and acceptable terms. Flatirons, vacuum cleaners, washing machines—in fact, almost anything—could be secured by customers with good credit on ten days' free trial. This was particularly true during campaign periods. Terms of payment also were made easy for the purchaser. House-wiring was sold on terms of nothing down and twenty-four months to pay.

But nowadays business is not so hard to get. There is a pretty lively demand for electrical goods for cash. Moreover, experience has shown that it does not take ten days for a woman to decide whether or not she likes a vacuum cleaner. In house-wiring and other campaigns a majority of the purchasers will wipe out their indebtedness before the end of the stated period, especially if they are paying interest on the sales company's investment. So there seems to be a growing tendency to reduce the duration of the trial period to five days or less. Deferred payments have likewise been reduced in number, apparently with little or no adverse effect on sales, until now eight months to pay is considered in some quarters as good as twenty-four months was formerly.

TRAINING NECESSARY TO SELL ELECTRIC RANGES

Analysis of Subject and Recommendations Are Made by Sub-Committee at Recent Northwest Convention

Recommendations of a very concrete nature were presented by L. S. Gilham before the recent convention of the Northwest Electric Light & Power Association in the report of the range sub-committee on training salesmen, demonstrators and company employees. It was brought out at the beginning that investigation points to the fact that not only is the average central station electric appliance salesman immature in years, as compared with the average salesman in the general run of other businesses, but the average central station salesman is too quickly hired—particularly the men who cover cities and other localities in personal calls upon customers and prospective customers in residential sections. Consequently the committee recommended a more detailed inquiry into the qualifications of prospective salesmen than is now the average custom; and in addition, as an important factor in determining the prospective salesman's qualifications, it urged the adoption of a policy by which more than one man would see and talk with a prospective salesman before he is employed. It was further recommended that not only should more than one man talk with the applicant, but that two or more interviews be secured with him before he should be put to work.

Principles of Appliance Salesmanship

In regard to selling goods on their merits the committee urged electric lighting utilities to instill into their appliance salesmen the following principles:

Perhaps in no other line is the folly of even the slightest misrepresentation so obvious as in the selling of electric appliances to the consumers of your own company's energy. The first profit is small. The important consideration is that the customer should use the appliance after she gets it; that she should like it, and that her use and satisfaction with it should pave the way for the sales of other appliances. The surest way to defeat this object is to misrepresent.

For instance, if a customer asks if an electric range is as cheap to operate as a gas range, say "No," frankly and promptly—but explain, of course, that your answer applies only to the actual cost of the fuel and not to the cost of the fuel and the food combined. Your candid and unequivocal admission of fuel cost will make her believe your explanation on the point of shrinkage of the food. When you are discussing the easy operation and care of the range, volunteer the information that the oven has a tendency to rust more readily than in other ranges, and that certain systematic measures must be taken to offset this tendency. Then, if her oven does rust, she will not blame you for selling her an inferior article or blame your company for permitting it. She knows it is her own fault, and her confidence in her range and in you and your company is not shaken.

Absolute frankness about the incidental shortcomings of your appliance will beget a confidence that will last and that will result in the sale of more appliances.

Be interested in your customer's actual needs. Don't try to load her up with more installment payments than she can conveniently take care of, for even the most useful appliance will lose its charm if it is the cause of financial worry. Don't sell her anything she won't use at all or enough to justify its purchase. And don't misrepresent.

The committee stated that it was of the opinion that:

A salesman's wage scale slightly more favorable to the men than the majority of salaries now being paid, the selection of men of more mature age and judgment than the average appliance salesman now at work, careful initial consideration of the salesman's qualifications, the establishment of a policy that the applicant must pass muster on two or three different occasions and with two or three different men before he goes on the pay roll, followed by a more intensive training than is now customary, will go far toward improving the work of the sales forces of the central stations and will go still further toward elimination of the vast amount of actually harmful work that must now be laid to the door of inexperienced, inefficient salesmen who day after day go into the homes of users of electric service and

who, through their lack of understanding of the field for electric appliances in the home, as well as their inability to explain and illustrate properly the use of such appliances, are responsible in a large degree for the lack of understanding and appreciation of such appliances by the average man and woman.

As regards demonstrators and employees the committee had the following to say:

A much higher power than a central station manager is responsible for the few successful demonstrators of electric cooking now at work among users of electric ranges throughout the country.

The need for thousands of capable demonstrators is so apparent as to make discussion of the situation unnecessary.

It is your committee's belief that a natural aptitude in cooking, combined with facility of speech and absolute sureness of their knowledge of the operation of an electric range as applied to a wide range of cooking, is the essential that central station men must look for in employing demonstrators.

Your committee believes that very little investigation of conditions among those employees of central stations who most come in contact with the public will very quickly divulge the fact that the paramount need in the training of such employees is constant emphasis of the necessity of unfailing courtesy, together with a better fundamental knowledge of household electric appliances, their uses, advantages and economy of operation.

ADVERTISING TO CLASSES OF CUSTOMERS EFFECTIVE

Results of a Campaign in Which Devices Suited for Certain Trades and Professions Were Advertised by Direct Appeal to Such Customers

Careful analysis of the results of a great deal of direct-by-mail advertising has led some members of the commercial department of the Commonwealth Edison Company of Chicago to form the following conclusions: If direct advertising—letter or circular matter—is mailed to residential customers in order to get the attention of women, it is possible to create a desire for the electrical device, but it is difficult to get a woman to fill out an inclosed card requesting a salesman to call. She prefers to go downtown or to her neighborhood store to look over the stock and buy. The exceedingly persistent tactics of the many house-to-house salesmen in nearly every trade are probably responsible for this apparent lack of responsiveness in the city's feminine population. There are instances in which circular letters to residence customers have brought good results, but the responsiveness is not assured with so much certainty as in the business field.

On the other hand, direct advertising sent to commercial and manufacturing companies on central station lines brings good results, a part of which are traceable. The men in these industries are busy and would rather have the central station company send its representative to explain a device in which they have become interested than to take the time to go to a store to look into it themselves. For this reason mailing cards sent with advertising to commercial and manufacturing institutions are returned.

Realization of this has led the company to conduct a mailing campaign aimed at the responsive commercial and manufacturing field. The table herewith gives a summary of this work and of the traceable results it has accomplished. In addition to the traceable results, this sort of advertising always brings business into the company's stores. Observations of the sales in advertised lines show that the data in column six of the table should be increased by from 20 per cent to 50 per cent to get a correct measure of the effectiveness of the advertising.

RETURNS FROM ADVERTISEMENTS MAILED TO BUSINESS HOUSES

Date Mailed	Number of Pieces Mailed	Classes of Trade Appealed to	Devices Featured	Number of Replies Received	Sales Made by Following Replies
Nov., 1916	3,200	Drug stores, saloons, ice-cream parlors	Water-heater, drink mixer, electric stove	43	30
Dec., 1916	2,000	Drug stores, saloons, ice-cream parlors	Drink mixer	39	22
Jan., 1917	6,000	Tailor shops	Tailors' irons	56	38
Feb., 1917	2,000	Doctors, dentists, hospitals	Electric sterilizer	180	9*
May, 1917	2,000	Women who sew at home	Sewing-machine motor	75	65
May, 1917	5,000	Small stores	Vacuum cleaners	65	40
Oct., 1917	10,000	Barber shops, beauty parlors, baths	Fans, vibrators, shoe drill, water heater, violet-ray machine, humidifier for cigars, hair dryer, razor sharpener, hair cutter	40†	26
Oct., 1917	5,000	Industrial plants, restaurants, stores	Exhaust fans	16†	

*Poor deliveries on goods account for lack of greater number of sales. †To date.

As the table indicates, no circular matter was used

Hot Drinks On Cold Days
DRINK MIXERS
Commonwealth Edison Company
EDISON BUILDING, 72 West Adams Street
TEAR OFF ALONG THIS LINE
GENTLEMEN:
Please send me information and prices on the following:
☐ WATER HEATER ☐ DRINK MIXER ☐ ELECTRIC STOVE
With the understanding that this does not obligate me in any way.
Yours truly,
NAME
ADDRESS
PHONE

TYPICAL COLORED ADVERTISEMENT SENT TO CAREFULLY SELECTED PROSPECTIVE CUSTOMERS

in the summer months because the company was conducting an intensive campaign with salesmen. The data on replies, if analyzed in conjunction with intimate knowledge of the mailing lists which are used,

indicate a distinct advantage in favor of special lists. For instance, the sewing-machine advertisement "pulled" strongly, in part because the list was a good one secured from a department store. It comprised women who make a business of doing sewing at their homes. The data on the October campaigns were still incomplete at the time of writing.

ATTRACTIVE COLORS AND CAPTIONS

As typical of the mailing pieces used in this campaign, one of the water-heater and drink-mixer advertisements is reproduced herewith. The art work as well as the printing is done in two colors—black and red. The headings used over the advertisements mailed in the consecutive months, as shown in the table, were as follows: November, "A Warm Reception," "Hot Drinks on Cold Days"; December, "A Good Mixer"; January, "For a Pressing Business"; February, "$H_2O + e/r = ?$"; May, "Ask the Woman Who Uses One," "Bright, Clean Stores Attract the Best Class of Trade"; October, "Electric Time Savers for the Backs," "Ventilation."

STANDBY SERVICE INSURES STEADY STEEL PRODUCTION

Outline of Provisions of Contract for This Central Station Service and Sketch of Conditions That Led Up to It

In a certain steel mill in the United States the possibility exists that the flow of producer gas to its large gas engines might be interrupted for a short period. Should this failure occur, hydrogen, which is also fed to the engines to be exploded with the producer gas, might continue to be fed to the engines and be exploded in an unadulterated state in the engine cylinders. An exploding charge of pure hydrogen in this fashion would without doubt wreck the cylinder and possibly the entire engine. Inasmuch as the engines in question are rated at 5000 kw., the power loss and consequent mill delay resulting from such an accident would be very disastrous.

To insure itself against shut-down from these causes, the steel company has contracted with a light and power company for 5000 kw. in standby service. The circumstances leading up to the completion of this contract are told by the general manager of the central-station company as follows:

> At the time the steel company's plant was under construction the company made a power contract with us for operating one of five centrifugal pump units supplying water for the various operations in its plant. This pump requires approximately 500 kw. and operates continuously twenty-four hours per day. The contract was made on account of the great importance of having an absolutely continuous supply of cooling water for the blast-furnace linings. The other pumping units are normally operated from the steel company's gas-engine-driven plant. A year ago the company asked us to install in our substation adjoining its plant transformers equal in capacity to one of its gas-engine-driven units in addition to the 500 kw. of continuous load, and to hold this amount of power for the company's use in emergencies, at the same time offering to pay the entire cost of installing the necessary apparatus.
>
> We thereupon placed orders for two 2500-kw., three-phase transformers, stepping down from 33,000 volts or 66,000 volts to 6600 volts, the pressure used in the steel company's plant, and have just recently completed this installation. In doing so we have removed the 500-kw., three-phase transformer formerly used for supplying power to the steel company's pumping unit, and this power is now taken from one of the larger three-phase units, the other one not being normally connected on either the high-tension or the low-tension side. We built a single three-phase combination overhead and underground transmission line from our substation to the generating plant of the steel company, which is kept alive up to the disconnecting switches on the line side of an oil switch connecting directly to the steel company's main 6600-volt station busbars.
>
> The contract provides that the steel company may in emergencies connect one or two additional pumping units to our circuits without notice to us, but that in the event of its requiring a greater amount of power than these three pumps would take it is to give us sufficient notice and we have the right to say whether it can have the emergency power or not, and if so, how much. In case we elect to give the company the power, the other transformer is placed in service and the operators in the steel company's station synchronize their machines with our system and take power up to the limits previously fixed. These limits are fixed, of course, by the demand being made at that time on our plant by other large and important wholesale customers.
>
> Thus far we have operated in parallel with the steel plant only for short periods in order to try out the apparatus and connections, but we feel sure that the arrangement will be perfectly satisfactory, although the speed regulation of the gas-engine-driven units is not close enough to provide smooth parallel operation with our waterwheel-driven generators. The fluctuations have not been serious enough to disturb either our voltage or frequency.

ONE WAY TO POINT OUT THE EXISTENCE OF A MARKET

How a Central Station Company Which Does Not Sell Appliances Stimulated Local Activity in Vacuum Cleaner Sales

The Dayton (Ohio) Power & Light Company does not do a retail appliance business. It does endeavor, however, to keep retail dealers at Dayton as well as manufacturers awake to the fact that Dayton is a good market for electrical goods. Last March the company, temporarily discontinuing its policy of staying out of the retail business, put on a thirty-day suction-sweeper campaign. In that period the campaign crew of ten men sold 200 cleaners.

This in itself was a good month's work, but the after effects of the sale were also gratifying. In the months following the sales the local electrical dealers all found the demand for vacuum cleaners very much stronger. While they could not attribute this directly to the sale, it is believed that the interest aroused by the central station's campaign force was in the main responsible for stimulating these retail sales. Moreover, three sweeper companies which formerly thought Dayton a poor market have now opened branches there, since the thirty-day campaign pointed out how easily a vacuum cleaner demand could be created in the city. What the company's campaign really accomplished, besides selling 200 cleaners outright, was to show other cleaner manufacturers and agents that they were not properly cultivating the local cleaner market. Thomas F. Kelly, commercial manager of the Dayton Power & Light Company, in speaking of these results before the commercial men of the Ohio Electric Light Association, expressed the belief that the full results of this campaign should interest central station men who under present circumstances do not wish to finance an expensive campaign.

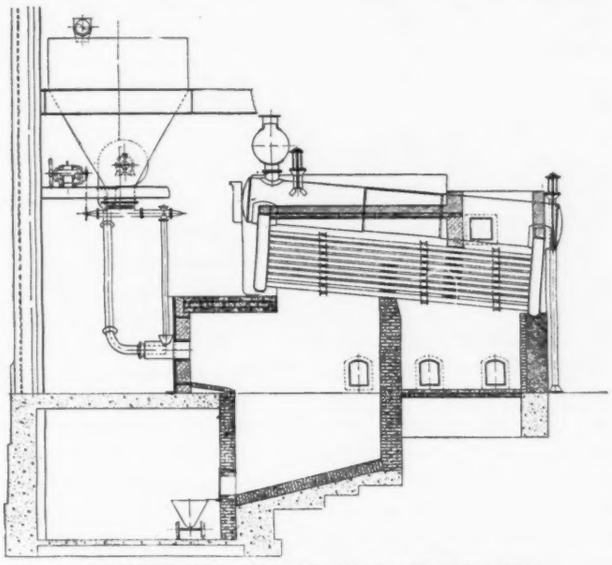
ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

EFFICIENT UTILIZATION OF FUEL OF LOW GRADE

Results of Test Give Promise of a Future for Powdered Coal—The Furnace Has Been in Constant Use for Nine or Ten Months

AT THE Parsons (Kan.) plant of the Missouri, Kansas & Texas Railway is a boiler installation which has been equipped throughout for utilizing pulverized fuel. Some very low-grade fuels are being burned, and from the results of tests which have been made the future for powdered coal seems bright, according to H. R. Collins and Joseph Harrington, co-authors of an article on "Methods for More Efficiently Utilizing Our Fuel Resources" in the October issue of the *General Electric Review*. The plant is completely equipped with crushing, drying, pulverizing and conveying equipment, which is fully described in the authors' original article. The construction of the boiler and furnace and the relative position of the hopper supplying pulverized fuel to the furnace are shown in the diagram.



ARRANGEMENTS FOR BURNING POWDERED FUEL

Three different fuels were tested last June having a considerable range in quality. The first was Texas lignite, which had been stored in the open air for over six months and subjected to freezing and thawing and influence of the sun and wind all this time. It was not necessary to dry this lignite to the same degree that the other coals were dried, as 17 per cent of the moisture in the coal as fired did not affect its apparent quality at all. The second coal, which was a fairly high-ash fuel from southern Kansas, is that which is usually burned at this plant. For the last test a carload of semi-anthracite screenings was obtained.

As shown by the accompanying extracts from the performance data, the furnace and grate efficiency were very high, and the loss due to combustible in ash was negligible. In the case of the Cherokee slack the ash fused and ran down to the bottom in molten streams. Practically no dust was encountered in the ash pit with this fuel. All of the ash remaining appeared to be liquefied or at least deposited in a plastic condition.

During the test there was a slight gray haze apparent at the top of the stack. Analysis showed that only 2 per cent of this, however, was combustible. Since the CO loss was in direct proportion to the length of the plane, this indicates that there is some relation between the volatile matter in the fuel and the CO loss. Gas temperatures nearly 200 deg. Fahr. in excess of what could probably be expected were obtained in the stack, but this was due to the dirty condition of the boilers before the tests were started.

Without doubt the furnace condition with the semi-anthracite coal, so far as could be determined, was nearly as ideal as one could imagine. The flames did not reach the tubes at any time, and the furnace gases were completely burned and transparent. The unaccounted-for loss in this test was also the least and the furnace efficiency was the greatest for any of the tests. There was no apparent fusing of the brickwork, which might occur if the ash had a fluxing action thereon. This furnace has been in constant use for nine or

REPORT OF TESTS AT M., K. & T. RAILWAY SHOPS, PARSONS, KAN.
(191-hp. O'Brien water-tube boiler, vertical baffle, equipped for burning pulverized coal)

	Lignite from Texas	Cherokee Slack, Mineral Mine, South Kansas	Semi-Anthracite from Kansas
Furnace temperature, deg. Fahr	2352.0	2329.0	2408.0
Stack temperature, deg. Fahr	597.9	534.6	624.3
Per cent of rated horsepower developed	119.0	129.0	137.0
Water evaporated, actual, per lb. coal as fired, lb.	4.953	6.824	8.657
Necessary losses:			
Heat absorbed by moisture and burned hydrogen up to temperature steam	6.56	3.92	2.90
Heat absorbed by theoretical amount dry gas up to temperature steam	4.98	5.13	4.82
Heat available for unit	.....	.....	.....
Highest theoretical efficiency	88.46	90.88	92.27
Furnaces and grate losses:			
Heat loss due to combustible in ash	.....	.....	.....
Heat absorbed by excess air up to temperature steam	0.57	0.83	0.53
Heat loss due to production of CO	0.86	0.37	.....
Heat available for boiler	87.05	89.68	91.75
Furnace and grate efficiency	98.40	98.69	99.44
Boiler losses:			
Heat loss due to theoretical amount gas, moisture and hydrogen above temperature steam	5.25	3.64	5.36
Heat loss due to air leakage through setting	1.36	0.24	0.41
Heat loss due to radiation and unaccounted for	24.27	27.89	16.33
Boiler efficiency	65.82	64.61	75.90
Combined efficiency	57.32	58.00	69.64
Ratio combined efficiency to highest theoretical efficiency	64.80	63.90	75.49
Capacity of furnace, cu. ft	874.0	874.0	874.0
Cubic feet per pound coal, minute	35.0	43.7	51.4
Cubic feet per pound of volatile combustible per minute	48.5	54.6	70.5

ten months and the interior seems to be in good shape.

The ash from the lignite and semi-anthracite coals did not fuse, but there was a small deposit in the ash pit of a yellow, sandy-looking ash which appeared to be entirely free of combustible matter. A drop in draft between the top of the third pass and the furnace of about 0.05 in. in a boiler ten tubes high, operating at 25 or 30 per cent overrating, does not seem natural, but the draft readings throughout all three tests were checked and repeatedly verified. This opens up a very interesting line of thought as to the draft requirements in this type of installation. The small loss is probably due to the small gas volume and consequent low frictional resistance in the boiler. During the three days when the boilers were under observation there was no sign of slagging of the tubes.

Generators, Motors and Transformers

Modern Dynamo-Electric Machinery.—ALEXANDER GRAY.—Continuation of a series on "Modern Dynamo-Electric Machinery," this installment dwelling on the theory of operation, design, control and method of protecting rotary converters.—*Journal of the Franklin Institute*, October, 1917.

Lamps and Lighting

Street-Lighting Specifications.—Refers to three clauses in specifications prepared by a joint committee which have caused considerable discussion. These clauses refer to the measurement of street illumination and the use of the words "minimum illumination."—London *Elec. Review*, Sept. 21, 1917.

Generation, Transmission and Distribution

Future of Hydroelectric Industry in the French Alps.—J. RÉVIL.—France has been especially favored by nature, says the author, in the possession of that source of energy which the French picturesquely term *houille blanche*, or white coal. The dynamic power inherent in her mountain streams and easily made available is estimated at more than 10,000,000 hp., leaving Germany, with only 1,500,000 hp., far behind. Large strides have already been taken in the development of these sources of water power, 528,000 hp. now being utilized in three mountain districts, as against 145,000 hp. in 1903. The author takes up in rotation the possibilities and the accomplishments in various regions as brought out in authoritative reports, closing with a strong indorsement of the project before which, he says, all others pale—that of damming the Upper Rhône and transmitting to Paris a great part of the energy that it would thus be possible to generate. A plan much favored to make this long-talked-of achievement an actuality calls for the erection at Génissiat of a dam 76 m. (250 ft.) high, thus creating a lake 23 km. (14 miles) long and covering 380 hectares (939 acres), or all the valley of the Rhône to the frontier. A fall of from 67 m. to 69 m. (220 ft. to 226 ft.), according to the period of rise and fall, would thus be obtained. The power that could be generated would equal that derivable from 1,500,000 metric tons (1,650,000 tons) of coal, or half the production of the basin of Lens. All the natural and geological conditions are declared to be favorable to building the dam proposed.—*Revue Gén. des Sciences*, Sept. 15-30, 1917.

Installations, Systems and Appliances

Modern Developments in Roentgenology.—L. ERASMUS ELLIS.—The author mentions briefly some of the most important types of apparatus used in the modern production of the Roentgen ray, pointing out that the time-honored coil with make-and-break excitation holds its own either in its original form or with some modification to improve the quality of the ray produced. The high-tension rectifier or transformer is also very popular. Some details are given about the modern types of X-ray tubes. After touching on the mechanical and physical facts connected with X-ray productions, the author turns to some medical and physical applications of this apparatus. A brief discussion follows the table.—*Transactions of the Southern African Institute of Electrical Engineers*, June, 1917.

Carbon-Tube Furnaces.—J. A. HARKER.—A discussion of the problems involved in making carbon-tube furnaces and some of the disadvantages of this type of furnace. The construction of spiral-element, hollow-tube carbon furnaces is discussed briefly, and remarks are included on induction furnaces, vacuum furnaces and those with granular and molten-metal resistors.—*Transactions of Faraday Society*, June, 1917.

Industrial Switch Gear.—Description of a three-phase outfit used in a flour mill and made out of stock parts. This feature is emphasized as it is thus possible to supply switch gear of the most elaborate character on short notice.—London *Engineering*, Sept. 7, 1917.

Electrophysics and Magnetism

Photoelectric Sensitivity of Various Substances.—W. W. COBLENTZ and W. D. EMERSON.—The paper summarizes results of an investigation of various substances to determine the increase in electrical conductivity caused by the action of light upon them and for electrical discharging activity when they were charged to a negative potential in an evacuated chamber and exposed to light. Selenium, stignite, boulangerite, jamesonite and silver sulphite show an increase in electrical conductivity on exposure to light. Pure gallium and sulphur sulphite were found to have only a small photoelectric discharging action when charged to a negative potential and exposed to light. The electrical conductivity of tellurium, bolelite, bismuthinite and mixtures of the sulphite of lead and antimony were not changed on exposure to light.—*Journal* of the Washington Academy of Science, Oct. 19, 1917.

Results of Magnetic Observations.—DANIEL L. HAZARD.—Report made by the United States Coast and Geodetic Survey in 1916 giving the results of the magnetic observations in thirty-three states and territories. The declination, dip, horizontal intensity and date of test are given for each of the stations, which are indicated by their latitude and longitude.—*Department of Commerce Special Publication No.* 42.

Units, Measurements and Instruments

Suggestions for the Prevention of Mistakes in Meter Reading.—G. W. STUBBINGS.—Mistakes in meter reading, the author says, may have far-reaching consequences, causing friction with consumers and involving great trouble which is difficult to adjust. The author outlines some of the most frequent causes of error, telling how they can be avoided, and suggests a set of instructions for meter readers. Among the suggestions

are: Read the meter and make calculation twice; test the meter roughly on one lamp; make notation of stoppage of meter; compare consumption with previous reading or corresponding period; inspect seals, and avoid conversation with consumers and do not try to answer complaints.—London *Elec. Review*, Sept. 21, 1917.

A New High-Tension Meter.—P. F. DUFOR.—Meter contains only low-tension elements, the use of instrument transformers being avoided by connecting directly to the consumers' step-down transformer.—Abstracted from *Revue Gén. de l'Elec.*, in London *Elec. Review*, Sept. 21, 1917.

Probe-Wire Measurements of Anode Fall of Potential.—JOHN T. TATE and PAUL D. FOOTE.—A film of high resistance forms at the surface of a probe placed in the anode glow. If a voltmeter is employed for the measurement of anode fall, the readings must be corrected to allow for the potential drop through this high-resistance film. Such a correction would be impracticable on account of the varying nature of the film. Since the probe functions as an anode during voltmeter readings, evidence has been obtained for the existence of an anode polarization similar to the polarization at the cathode in a highly ionized gas, as observed by Skinner. The magnitude of the anode polarization is very much less than the cathode polarization. This explains the fact observed by Skinner that in an auxiliary transverse discharge through the cathode glow the resistance and the current potential curves are characteristic of the auxiliary cathode employed.—*Journal of* the Washington Academy of Sciences, Sept. 19, 1917.

A Method of Observation and Measurement of Rapid Periodic Magnetic Phenomena.—P. WOOG and J. SARRIAU.—The method employed is to make vibrate a small piece of metal attached to a Koenig manometric capsule. An examination of the deformations of the flame due to the vibrations transmitted to the capsule enables a study of the magnetic field of the vibrator to be made both as regards magnitude and variation. So as not to introduce perturbation a glass capsule is employed. The metal is a disk of iron, 18 mm. thick, with a hole 6 mm. in diameter in its center. It is fastened to the membrane on the outside of the capsule. The capsule is traversed by a current of coal gas at a constant pressure of 13 mm. of water. The electro-vibrator is placed perpendicularly to the membrane and 62 mm. distant from it. The observations of the flame are made by means of a rotating mirror, or the results may be registered photographically.—Abstracted from *Comptes Rendus*, April 16, 1917, in *Science Abstracts*, Section A, Aug. 30, 1917.

Emanation Electroscopes.—O. C. LESTER.—Results of an investigation to determine a method of calibrating emanation electroscopes and to obtain the constants therefor.—*American Journal of Science*, September, 1917.

Telegraphy, Telephony and Signals

Thomson-Houston System of Automatic Telephony.—A résumé of three patents granted to the French Thomson-Houston company in the domain of automatic telephony. These relate, first, to the operation of an automatic network embracing 10,000 lines; second, to a new arrangement by which a subscriber desiring a number that for any reason is out of service will be connected automatically with a special line and operator; third, to a new individual commutator which allows a subscriber's line to be connected with the apparatus of a standard automatic system.—*Revue Gén. de l'Elec.*, Sept. 8, 1917.

Telephonic Transmission Losses.—K. OGAWA and T. ARAKAWA.—An account of experiments conducted at the Electrotechnical Laboratory, Tokio, Japan, to determine the transmission losses in bridged impedances, series resistances and capacitances with different types of lines and different telephonic apparatus types attached thereto. After discussing briefly the problems in telephonic transmission, the authors develop formulas for the characteristics of telephone transmission lines and finally present a number of tables and curves, giving the limiting lengths for lines with different apparatus connected thereto and relations between calculated and observed losses with apparatus inserted at different points along the line.—*Report No.* 19 of the Second Section of the Electrotechnical Laboratory, Tokio, Japan.

Relation of Audibility Factor of a Shunted Telephone to the Antenna Current.—BALTH. VANDERPOL.—According to the author the assumption that the audibility factor of a shunted telephone is in general proportional to the square of the antenna current, as stated by Hogan, seems to be invalid. For large values of the current it was found that there is a proportionality between the audibility factor and the square of the current, and for weaker signals the audibility factor was found to be proportional to the power of the current varying between 2 and 0.7 in agreement with Love's expectations. The author expects to continue the investigation.—London *Philos. Mag. and Journal of Science*, September, 1917.

Miscellaneous

Disk-Wheel Stress Determination.—S. H. WEAVER.—This article describes and applies a simplified method for determining the centrifugal stresses in a disk wheel of given irregular shapes of section. Stodola's disk theory is assumed, together with his formula for disks of hyperbolic-section profile. The formulas are then transformed so as to give the tangential stresses at the inner and outer radii in terms of the radial stresses, ratio of radii and shape constant of disk section. For commercial work approximate equations are given which cover the practical disk operations and within the limits shown have a range of error of less than 1 per cent. As a further labor-saving device when a number of disks are to be estimated, the approximate equations have been placed in an alignment-chart form. A practical example is included showing an actual application of the method to a disk wheel of the usual type.—*Gen. Elec. Review*, October, 1917.

Construction of Electrical Material.—HENRI SCHUHLER.—Extracts from an inquiry into French production of electrical apparatus and the foreign assistance which France has received. Among the subjects taken up are the French industry in the construction of electrical material before the war, construction of electrical material in Germany, German imports into France, means proposed to limit German aid and develop the French industries, and future of electrical construction after the war.—*Association Nationale d'Expansion Economique.*

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

SIGN LIGHTING AND THE FUEL SUPPLY PROBLEM

Attitude of Utilities in Fuel Conservation Is Considered by the National Committee on Gas and Electric Service

The question of electric sign lighting, as well as other matters concerning the coal supply of the public utilities, and the attitude of the utilities toward the general problem of fuel conservation were considered at a meeting of the National Committee on Gas and Electric Service in Washington on Nov. 1. It was expected also that the committee would have a conference with the Fuel Administrator to consider these various matters as they affect public utility relations.

SIGN OWNERS WANT TO KEEP THE GREAT WHITE WAY BRIGHT

Property Holders on Broadway Take Up Question of Sign Lighting with Fuel Administrator—Small Energy Consumption

About 100 owners of property on Broadway and Fifth Avenue, New York, held a conference on Oct. 29 in Washington with Fuel Administrator Garfield to discuss the subject of discontinuance of electric sign lighting. Members of the delegation argued that curtailment of sign lighting would not only deprive those who had made an appreciable investment of the income on it but would also inflict unnecessary deprivation of light which attracts hundreds of thousands to Broadway. They also said that the light represented surplus energy and did not involve extravagance or waste of coal.

Dr. Garfield said that the subject had been taken up by the Fuel Administration, but that no decision had been made as to curtailment of the lights. He spoke of the urgent necessity of saving as much coal as possible and informed the delegation that everything must be done to minimize the waste.

A compromise proposal has been suggested under which lights on Broadway would not be turned on until 8 o'clock p. m. this winter instead of at 4.30 o'clock or 5 o'clock as formerly.

John W. Lieb, vice-president and general manager New York Edison Company, made a statement on Oct. 31 in regard to the question of sign lighting in New York. He called attention to the estimate that such lighting consumes only about six-tenths of 1 per cent of the energy and that the actual saving in coal would be less than one-tenth of 1 per cent.

"It has been the experience abroad that cheerful surroundings and a certain amount of gayety have a very favorable effect on the convalescence of wounded soldiers," Mr. Lieb declared, "while gloomy surroundings have a depressing and unfavorable effect. For this reason our allies, while prohibiting street illumination and displays in order not to invite hostile air craft, have found it necessary to maintain theaters, moving-picture shows and other forms of entertainment to help cheer up the soldier."

Because of these facts the situation is one of psychology rather than of economy, of impression than of actual important waste. Mr. Lieb added that if it appears important to the national or municipal authorities to eliminate the signs there is no doubt that the lighting and power companies throughout the country will co-operate in every way, without regard to any loss of revenue. The problem is national rather than local in character, and if, in order to avoid even the appearance of waste or extravagance it becomes necessary to take action, it should be undertaken by the national authorities involving a public announcement by Dr. Garfield.

WASHINGTON VIEWPOINT ON ELECTRIC SIGN LIGHTING

Coal Supply Problem Considered in Its Relation to Essential Industries—Hindsight in Water-Power Development

The Washington viewpoint on the sign-lighting question is thoroughly bound up with the order issued by the priority board, which forbade the use of open top cars for the transportation of a number of materials. Every effort has been made in Washington recently to obtain more coal for all of the industries.

The Washington correspondent of the ELECTRICAL WORLD reports that there is no intention on the part of the authorities to discourage the use of all electric sign lighting. Many questions have come up in regard to the possible use of coal and the lack of coal cars for furnishing coal not only for the public utilities but for the use of homes in many parts of the country.

It was stated to the Council of National Defense that many public utilities had been more or less obliged to run on part time for the lack of coal. It was also stated that no coal cars could be obtained. Many munition plants were obliged to run on part time for the lack of coal. In the city of Detroit alone there were more than 59,000 homes without coal.

In these circumstances the Washington viewpoint is that the electric light companies should not wastefully expend coal for furnishing sign lighting in such places as the Board Walk in Atlantic City, Broadway in New York and other celebrated "white ways" throughout the country.

Some Senators who are still in Washington, as well as many Representatives in Congress, believe that the administration should have carried out promises made five years ago, when it came into power and announced

that one of the first things to be done would be the passage of the so-called conservation bills.

The government at Washington, so far as can be ascertained by the Washington correspondent of the ELECTRICAL WORLD, intends to discourage the wasteful use of coal for electric signs throughout the winter. Members of the Council of National Defense hold out a hope that when the spring comes and there shall not be so much need of coal a different policy for such lighting will be pursued.

BELL MEMORIAL UNVEILED AT BRANTFORD, CANADA

Noted Inventor of the Telephone Is Present at Ceremonies Held in His Honor in Ontario City

The Bell Memorial, erected in honor of Dr. Alexander Graham Bell and his invention of the telephone in Brantford, Ont., in 1874, was unveiled at Brantford on

Oct. 24 by the Duke of Devonshire, Governor-General of Canada. Dr. Bell was present and took part in the ceremonies.

ENGINEERING COUNCIL FOR HYDROELECTRIC DEVELOPMENT

Remedial Laws Favored to Promote Conservation—Movement to Co-ordinate and Strengthen Work of Engineering Committees with Government

The Engineering Council met on Oct. 11 in the rooms of the American Society of Mechanical Engineers, Engineering Societies Building, New York.

The rules committee submitted a draft of rules for the admission of other societies to the council, and progress was made in their consideration.

The committee on public affairs reported on a number of requests that the council support pending or proposed legislation.

Remedial laws intended to promote hydroelectric development were favored and the council voted to offer its co-operation to the United States Chamber of Commerce, which is interesting itself in this matter.

A movement to co-ordinate, unify and strengthen the work of various engineering committees co-operating with the federal authorities at Washington was considered favorably. H. W. Buck and Charles Whiting Baker were appointed council conferees.

CORRECTING WASTE IN USE OF ELECTRICAL ENERGY

Empire State Gas & Electric Association, Anxious About Coal Supply, Points Out Ways of Economizing

Officials of the Empire State Gas & Electric Association, whose members feel the urgent necessity of coal conservation, have conducted correspondence with the Washington authorities in order to present their needs for consideration. The correspondence has dealt with measures for the conservation of both electrical energy and gas, and it contains a number of suggestions.

A letter sent by the association, through Charles H. B. Chapin, the secretary, to Edwin B. Parker, member of the priorities committee, is a reply to a letter from that gentleman requesting "further suggestions as to the ways and means of conserving gas and electric energy without unnecessarily disturbing commercial and industrial conditions or causing any unnecessary loss, damage or suffering."

In his letter Mr. Chapin, after referring to ways in which gas is being wasted, says in part:

Electricity is being wasted:

1. By continued use of the old-fashioned carbon-filament or gem lamps for lighting instead of the modern and more efficient tungsten lamp.
2. By continued use of old-fashioned and inefficient types of lamps for street lighting.
3. By continued use of belt drive for machinery in manufacturing establishments instead of the more efficient group or individual motor drive.

We would respectfully suggest that an educational campaign in relation to these matters might be undertaken. In our judgment the series of War Bulletins being published by the Chamber of Commerce of the United States would be an effective medium for such a campaign. In addition, cards might be prepared to be hung over gas ranges and other gas and electric appliances pointing out the need of economy.

The present waste is very great, while the means to eliminate it are simple and to the financial benefit of the consumers.

The gas and electric companies of the country should, and we have no doubt would, assist and co-operate in such a campaign as has been suggested in every way possible.

Exhibits sent with the letter of Mr. Chapin point out the economy of tungsten over carbon lamps, the continued use of inefficient types of lamps and of uneconomical methods in street lighting. Waste in factory power was also considered.

ELECTRICAL MANUFACTURERS' COUNCIL MEETS IN NEW YORK

Considers a Number of Matters of Interest to the Three Organizations Which Have Delegations to It

A meeting of the Electrical Manufacturers' Council was scheduled to be held on Nov. 2, 1917, at the Engineers' Club, New York City. This council is made up of delegations of four representatives from each of the three electrical organizations—the Electric Power Club, the Electrical Manufacturers' Club and the Associated Manufacturers of Electrical Supplies. It was expected that a number of matters of interest to the respective organizations would be presented to the council.

ENGINEERING CONFERENCE IS HELD IN WASHINGTON

Called by Ambrose Swasey—Recommendations to Be Made for Unification of Relation of Engineering Agencies to the Government

Invitations were sent recently by Ambrose Swasey to thirty-two of the various engineering bodies and committees rendering or desiring to render government service, asking each to send two delegates to a conference in Washington to be held on Oct. 26.

The delegates met at 10 a. m. on that day as guests of the Bureau of Standards. Following a statement by Mr. Swasey of the reasons for calling them together and after deliberations extending over the greater part of the day, a resolution was passed authorizing the chairman elected by the meeting (Col. John J. Carty of the Signal Corps) to appoint a committee of five, of which he was to be a member, to confer with the Engineering Council and the governing bodies of other engineering organizations with a view to formulating such recommendations, to be presented to a later meeting of the delegates, as would, if adopted by their constituent bodies, remove certain duplication of effort and representation and in general unify the relation of the various engineering agencies to the national government in the interest of the dignity of the profession and the successful conduct of the war.

PERSONAL CLASSIFICATION OF MEMBERS OF THE A. I. E. E.

Purpose Is to Enable Prompt Response to Be Made to Army, Navy and Other Governmental Departments

A blank form for information on which a complete personal classification of members may be based is being issued by the American Institute of Electrical Engineers. For the purpose of doing this work the Institute has appointed a classification committee of three members.

The form which is being issued to A. I. E. E. members is similar to one issued by the American Society of Mechanical Engineers on June 1. The form has been expanded somewhat over the one promulgated by the A. S. M. E., and it is being sent also to members of other engineering organizations. The expectation is that all known branches of engineering will undertake a classification of members on the lines proposed.

Accompanying the blank form sent to A. I. E. E. members is a letter of F. L. Hutchinson, the secretary, saying:

> Various branches of the army, navy and other governmental departments, as well as many industrial establishments, are calling upon the Institute for assistance in obtaining men of specified technical qualifications. To respond promptly and effectively it is necessary that detailed information regarding the many Institute members who are available and anxious to serve shall be on file at Institute headquarters.
>
> Accordingly the directors have authorized the secretary to request each member to fill out and return the inclosed classification form, which has been prepared by the co-operation of several engineering societies with the object of covering all branches of engineering and of providing for uniformity in classification, in the hope that ultimately the records thus obtained by different societies may be combined in a single index in a central bureau.
>
> Your prompt co-operation, even although you have already filled out similar blanks for other organizations and whether you are available for service or not, is requested. Particular attention should be devoted to the record of your technical training and experience and the index schedule which follows.
>
> Although the immediate need of obtaining and indexing this information is to enable the Institute to render greater service to the government, the intention is to maintain a permanent file of such data, revised from year to year. This is needed in connection with the regular work of the Institute, and will probably prove of increasing value after peace has been declared in providing for the readjustment in the industries, with a view to the utilization of the services of the membership to the best advantage of the individual engineer and of the nation.

ANNUAL CONVENTION OF NEW JERSEY ASSOCIATION

T. H. Dudley Perkins Raises Question Whether Government Should Not Consider Extension of Maturing Obligations

The New Jersey Utilities Association held its third annual convention at the St. Charles Hotel, Atlantic City, on Oct. 26 and 27. Among the addresses on the program were:

"The Proper Relations Between Public Utilities and Public Utility Commissions," Ralph E. Donges, president Board of Public Utility Commissioners of New Jersey; "The Problem of Higher Operating Costs and Commission Control of Rates," Thomas Conway, Jr., professor of finance, University of Pennsylvania; "Public Utilities Doing Their Bit," John L. O'Toole, Public Service Corporation, Newark; "Interrelation of Various Obligations for Adequate Utility Facilities Under War Conditions," George W. Fuller, consulting engineer, New York; "The Financing of Public Utilities," T. H. Dudley Perkins of Bioren & Company, bankers, Philadelphia; "The Binding Force of Term Contracts with Special Relation to Public Utility Rates," Ralph J. Baker, Harrisburg, Pa.; "The Valuation of Intangibles for Rate-Making Purposes," Dr. F. Herbert Snow, chief engineer Public Service Commission of Pennsylvania; "Utility Troubles—Their Causes, Effects and Remedies," W. H. Roth, Philadelphia.

T. H. Dudley Perkins in his paper made the following definite suggestions concerning the financing of maturing obligations:

"In every community the Liberty Loan is given the right-of-way, and every patriotic banker devotes his time to promoting the public good by helping to place these bonds among his clients. The periods of rest between the placing of these loans are fully covered by such necessary financing as renewals of maturing obligations, thus eliminating the possibility of any new financing at this time. Indeed, the question of renewal of maturing obligations is in itself a most serious problem, and with each new piece of financing being done on a higher interest basis than the last it becomes a serious question whether the government should not consider the advisability of extending the maturing obligations which have been made for a period of more than one year and the maturity of which is not provided by such installment payments as car trust rentals, etc., so that at least during the period of the war our public service corporations should not be embarrassed by this expensive and difficult operation."

INCREASE IN THE RATES OF THE MILWAUKEE COMPANIES

State Commission Holds that Utilities Have Acted with Discretion and Judgment in Contracting for Coal

As stated in last week's issue, the Wisconsin Railroad Commission has rendered a decision approving increased electric and steam heating rates of the Milwaukee companies because of the higher cost of coal. Extracts from the decision follow:

Early in 1917 the coal shortage became acute. No assurances as to delivery or as to prices could be secured covering dock coal through previous sources, and the companies in order to protect themselves and the public contracted for coal from Illinois, Indiana and Kentucky mines. These contracts are advantageous when compared with anything that could now be secured through former sources. The coal is of poorer quality, but the net B.t.u. cost is considerably less. It seems clearly established that coal could not be purchased on a more favorable basis at the present time than that contracted for by the company, and that the companies have acted with discretion and judgment. Unless unforeseen contingencies arise the companies have protected their coal supply to at least April 1, 1918.

A careful analysis has been made of the coal costs under these contracts. Considerable deliveries have already been made. Such coal has been carefully tested and the B.t.u. efficiency has been ascertained from daily tests. These tests show that the coal purchased under present contracts will average substantially 10,900 B.t.u. (not dry) per pound of coal. None of the present contracts are on a B.t.u. basis. The mine prices include costs for separation of screenings from lump and the contracts provide that mine price is based on mining and day-wage scales then in effect, and this price is to be increased or decreased with change in such scale. One increase has become effective under this provision. Contracts are for net tons.

As to electrical schedules, the application is confined entirely to the energy factor and is limited to those cases where the monthly consumption is over 1000 kw.-hr. As to the smaller consumer, the cost of coal represents a relatively small percentage of the total cost of the service, while as to the large consumer it represents a relatively large part. It is not to be overlooked that the larger users, especially of power, are receiving a service substituted for one which otherwise would demand the direct use of coal, and in proportion as coal cost increases the relative saving or convenience of the substituted use of electric energy will be more than preserved. Furthermore, it is not felt that the justice of increased rates to the smaller consumer, a large part of whose charge is now made up of the demand factor, could be ascertained without a much more detailed analysis of all factors entering into that service than would be possible in this emergency hearing. Those rates are under investigation in the main cases now pending.

Several large power users appeared not exactly in opposition to the application, but with the earnest insistence that whatever was done in the matter the commission would carefully see to it that there should not be placed upon the shoulders of such large users a burden that ought in fact to be borne by other classes of consumers. We are confident that the order herein made will not have that effect. Certainly no pains or effort has been spared on the part of the commission to make certain on this point. On the part of some of the heating consumers it was strongly urged that consideration should be given to the fact that landlords are not in a position to shift the burden of increased heating rates to their tenants through changes in leases, some of which have a long time to run. While it is true that landlords may not be in a position at once to pass the added burden, it is perfectly clear that they are in no different position in that respect from that they would occupy were they supplying their own heat. Recent applications for heating service are quite convincing on that point. Nor is it believed that the additional cost of service under the new schedule herein put into effect is as great as would be the increase in the cost of operating isolated heating plants.

The increased revenue which will be derived through the schedule authorized will not compensate the applicants for the increased cost of coal alone and does not provide for any of the increased costs of labor.

For the months of June and July the coal cost per 1,000,000 B.t.u. was 22.2 cents. Applying this coal factor as a measure for relief over and above the coal costs of 12 cents per 1,000,000 B.t.u., which the company has assumed might still be normal, would give an increased kilowatt-hour cost of 0.396 cent and an increase of 25.5 cents per 1000 lb. of live steam and 18.4 cents per 1000 lb. of low-pressure heating steam. The cost per 1,000,000 B.t.u. to the company can be substantially calculated for the period ending March 31, 1918, subject, of course, to unforeseen contingencies, and this cost amounts to substantially 20 cents. No material change is to be anticipated in this coal cost factor during that period. The order will therefore fix the increase in rates on this basis. If no change takes place, the results will be the same as though the sliding scale sought by the petitioners were adopted.

The increases allowed amount to 0.31 cent per kilowatt-hour on consumption in excess of 1000 kw.-hr. per month and 20 cents per 1000 lb. of high-pressure steam and 14 cents per 1000 lb. of low-pressure steam.

With regard to the application for authority to discontinue flat rates for heating service, the commission is of

THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY —MILWAUKEE LIGHT, HEAT & TRACTION COMPANY

AMOUNT AND COST OF COAL USED FOR THE GENERATION OF STEAM

Period	Pounds of Coal	Cost per Ton of Coal Delivered	B.t.u. per Pound	Total B.t.u. (Millions)	B.t.u. for 1 Cent	Cents per 1,000,000 B.t.u.
Year ended Dec. 31, '15	343,789,007	$2.46	12,350	4,245,806	97,800	9.8
Year ended Dec. 31, '16	457,227,045	2.61	12,310	5,640,737	94,500	10.6
7 mos. ended July 31, '17	370,587,132	3.65	11,310	4,196,750	62,000	16.1
January, 1917	55,558,078	2.74	12,210	678,363	89,200	11.2
February, 1917	52,440,715	2.80	12,200	639,777	87,200	11.5
March, 1917	53,089,235	2.97	11,600	615,832	77,900	12.8
April, 1917	53,155,060	3.16	11,075	589,619	70,000	14.3
May, 1917	56,825,526	4.49	10,580	600,617	48,000	20.8
June, 1917	51,095,648	4.73	10,575	543,622	45,000	22.2
July, 1917	48,422,870	4.86	10,922	528,920	45,000	22.2

the opinion that this authority should be granted. If the effective dates of the rates herein ordered are postponed to apply only to such service as is rendered after the next meter reading, it would be about two months before bills would be rendered to certain consumers in accordance with the advanced rate, and the final meter reading and billing as to these consumers would not take place until nearly June 1. The order herein will provide for these rates being effective for six months for each consumer. This order becomes effective for meter readings taken Oct. 25. The date of the last meter reading for which bills shall be rendered in accordance with the rates herein authorized shall be April 24, 1918.

Electric Energy Schedule.—For all energy delivered in excess of 1000 kw.-hr. per month there is added to the rates now applicable 0.31 cent per kilowatt-hour.

High-Pressure and Low-Pressure Steam Schedules.—There is hereby added to the present rates an additional charge of 20 cents for each 1000 lb. of condensation for high-pressure steam heating and 14 cents for each 1000 lb. of condensation for low-pressure steam heating.

The rates above provided for shall be applicable to all meter readings from and including Oct. 25, 1917, to and including April 24, 1918. All customers affected shall be maintained in the same rotation as to meter readings and billings so that none shall pay for more days of service than the equivalent of the days of service between Oct. 1, 1917, and March 31, 1918, inclusive.

Unless otherwise hereafter ordered, the rates in effect at the present time shall in all things be restored upon the expiration of the period for the increased rates as in this order provided, except that flat rates shall not be restored.

COMPANIES ARE SOUND, SAYS SAMUEL INSULL

Increasing Coal Cost Need Affect Only Small Percentage of Total Expense of Commonwealth Edison Company

Speaking before the Commonwealth Edison Company Section of the National Electric Light Association and the Public Service Company of Northern Illinois Section of the N. E. L. A. at the annual meeting of the former organization on Oct. 25, in customers' hall, Edison Building, Chicago, Samuel Insull gave some very interesting data which show the firm position of Chicago public utility organizations. He said that the public utility business is one which it is popularly supposed could not profit in these days of general prosperity on account of the high prices of the materials used in its property and because its selling price to consumers is fixed. Arguing thus, certain people have made it appear that public utility securities were not what they have been said to be, namely, the best investment next to the securities of the United States government.

Mr. Insull said that although prices of materials used in the central station business had gone up and may continue to go up for some time, the traditional policy of the Commonwealth company of continually lowering rates will not be reversed unless this war lasts a great many years longer than is expected. The one great advantage in the central station business lies in the fact that the rapid growth of business brings an absolute necessity for new and additional machinery, and the development of the art has made it possible to purchase new machinery of very much higher efficiency than old machinery. Furthermore, growth of the business has been so rapid that old machinery which must become obsolete is at the time of obsolescence a very small percentage of total plant capacity and a small percentage of the investment involved. To illustrate this Mr. Insull referred to the fact that in 1912 generating capacity of the Commonwealth company was 230,000 kw. In 1916 it had increased 55 per cent to 360,000 kw., at the end of 1917 it will be 452,000 kw., and, on the basis of equipment now on order, in 1919 it will be 600,000 kw. In other words, the generator capacity of the company has increased threefold in seven years.

Good Increase in Gross

On the financial side, Mr. Insull said that in the first nine months of the year the increase in gross operating revenue amounted to $1,726,762, or 10.5 per cent over the same period for 1916. This increase was greater than the increase for the first nine months of 1916 over the first nine months of 1915. He estimated the total increase in gross for 1917 over 1916 at more than $2,000,000, and that the total increase in gross of 1917 over 1915 would be $4,000,000. Taking into account the fact that the company in this time reduced its rates to an extent of $1,000,000, the actual increase in gross business for 1917 over 1915 is more than $5,000,000. He expressed the belief that in 1917 the company would receive from the sale of energy alone over $25,000,000.

Mr. Insull stated that this growth was very satisfactory and that operating expenses had been kept down to a very satisfactory basis. There have been some increases, of course, but the only item which is out of proportion is cost of coal.. This he said was offset by increase in gross business, and he presented the following figures in illustration.

In 1916 the expenditures in round numbers were as follows:

Fuel	$3,642,000
Other operating expenses	8,265,000
Depreciation	2,822,000
Taxes and insurance	1,835,000
Bonded indebtedness	2,099,000
Depreciation	3,667,000
Making total expenditures for operation and fixed charges	$22,330,000

Of this total only 16⅔ per cent was expended for fuel. Mr. Insull added that 55 per cent of the fuel is burned in supplying electricity for operation of the Chicago elevated railways and surface lines. The Commonwealth company contracts with these companies specify that if coal increases above a certain price the company can add an increased charge. Therefore, even though no increase is made in retail rates, the increased coal cost need affect only 45 per cent of the total cost of fuel. In figuring increased cost due to the increased fuel cost, estimates should not be based on 16⅔ per cent, but on 16⅔ per cent less 55 per cent. Moreover, two-thirds of the coal is from company mines, and if coal prices rise out of reason the balance sheet will show a profit on mining operations from money paid to the company's own coal company.

Affairs Well in Hand

Mr. Insull said that he was talking to employees in this way because on many former occasions he had assured them that the company securities were the safest to buy with the exception of government securities. He wished to repeat this statement as true at present, and to assure employees that their dividends were as sure as their salaries. He advised them not to become stampeded by statements of persons who know nothing about the company standing, and expressed the belief that the company balance sheet for the coming fiscal year would not show a variation of $100,000 from last year.

Moreover, he said, if this war were going to last for any number of years, certain people would observe that the company had not yet begun to cut expenses. At the same time Mr. Insull expressed the belief that such drastic measures would not be necessary. He said that the company plans the same general policy of extension during 1918 as it followed previously.

Reverting again to the future, Mr. Insull pointed out the advantage through increased efficiency in production apparatus as the plants grow. At present, he said, the company uses on an average about 30,000 heat units to produce a kilowatt-hour or it takes about 2¾ lb. of coal to make a kilowatt-hour. It is estimated by the company's engineers that in 1918 the company will produce energy on about 2¼ lb. In 1919 he estimated that the company would produce energy on about 2.06 lb. In one or two years following 1919, he predicted, energy will be produced on less than 2 lb. of coal per kilowatt-hour.

As to the Public Service Company of Northern Illinois and Middle West Utilities Company, Mr. Insull said that the explanations which applied to the Commonwealth company also applied to these concerns,

although to a somewhat less favorable extent. He stated, however, that both would earn returns on their funded indebtedness and have something for surplus. In regard to gross business of the Middle West company subsidiaries, he said that in all probability the 1917 showing would be $12,000,000 against $9,000,000 for last year. Furthermore, the Middle West company will receive from subsidiaries $1,541,000 in 1917 against $1,479,000 in 1916.

"On the whole," Mr. Insull concluded, "we have every reason to be satisfied with the showing which our oldest and our youngest properties are making. We have very little to fear."

At the opening Mr. Insull referred to the fact that 519 employees of the company had gone to the front, and that three-quarters of these had volunteered. He expressed the belief that the preparations which the Insull companies had been making for the entrance of the United States into the war since war was first declared three years ago will stand them in good stead for its duration.

DISCUSS FUEL SITUATION AT NEBRASKA CONVENTION

N. E. L. A. Nebraska Section Gives Careful Attention to Problems of Coal and Rates—J. E. Davidson the New President

The annual convention of the Nebraska Section of the National Electric Light Association was held at the Paxton Hotel, Omaha, Oct. 24 and 25. The delegates were welcomed by Mayor James C. Dahlman. In the unavoidable absence of the president, A. C. Leflang of the Lexington Power & Light Company presided.

J. E. Davidson, vice-president and general manager Nebraska Power Company, Omaha, was called upon. Responding to the request of the members present, he discussed the future of the electric industry, the advance in prices of material and the enormous advance in coal cost, and their influence on the prevailing and future price of electricity, both for power and lighting purposes.

K. P. Goewey, Nebraska Power Company, read a very interesting paper on the sale and the future of the electric range. Both he and Walter Fagan of the Hughes Electric Heating Company interested those in attendance for over an hour by the use of lantern slides. They showed the uses of the electric range in dwelling and apartment houses. The delegates seemed to be considerably impressed and will make an effort to introduce the electric range in all central stations throughout the State.

J. B. Harvey, vice-president and manager York (Neb.) Public Service Company, read a paper on "Overhead Transmission Lines." He discussed construction methods and also gave personal experiences in the construction and operation of the transmission lines controlled by his company.

C. J. Snyder, engineer Nebraska Power Company, Omaha, read a paper on "Inductive Interferences; Rules and Regulations Covering the Construction of Overhead Transmission Lines." This described his experience in meeting with the State Railroad Commission and his efforts with the telephone companies and signal companies to work out a satisfactory basis which will meet with the approval of all who are interested and also meet with the approval of the State Railroad Commission.

E. A. Anderson, National Lamp Works, Cleveland, gave an instructive address on modern illumination. He used lantern slides to illustrate his points and show the more modern ways of street illumination as applied to large cities and smaller towns, and also referring to interior lighting.

R. L. Ponsler, Norfolk, Neb., read a very interesting paper on "Steam Economy." Considerable discussion followed as to the merits of the various engines and turbines and his experience with the "Uniflow" engine.

W. C. Ross, Nebraska Gas & Electric Company, Omaha, presented a paper on the "Fuel Situation." This covered present sources of supply, cost with direct relation to the cost of producing energy, etc. Mr. Ross's paper was followed with close attention, as the enormous advance in price of fuel bears so directly on the present cost of producing electricity that it was the most important subject discussed at the meeting.

The officers elected for the following year are: President, J. E. Davidson, vice-president and general manager Nebraska Power Company, Omaha; vice-president, T. H. Fritts, Central Power Company, Grand Island; secretary and treasurer, R. W. McGinnis, O'Neil Light & Creamery Company, O'Neil; executive committee—W. C. Ross, Nebraska Gas & Electric Company, Omaha; J. E. Shuff, Lincoln Gas & Electric Company, Lincoln; O. J. Shaw, Lincoln Traction Company, Lincoln; W. B. Roberts, Union Company, Omaha; A. C. Leflang, Lexington Power & Light Company, Lexington; J. B. Harvey, Public Service Company, York.

The newly elected officers and executive committee met after the convention adjourned and discussed plans whereby they can increase the Nebraska membership and further the electric interests of the State, bettering conditions as to rates and public policies.

REFILLABLE FUSE RULING IN THE NATIONAL ELECTRICAL CODE

Full Text of the Revised Ruling on Refillable Fuses, as Submitted at Recent Meeting in New York

In the account of the meeting of the National Fire Protection Association published in the issue of the ELECTRICAL WORLD for Oct. 27 an error was made regarding the National Electrical code rule on refillable fuses. The full text of the report of the committee on switches and cut-outs on this subject follows: "In view of the misinterpretation placed on the report of the committee in the March *Bulletin* regarding refillable fuses, the committee desires to submit the revised report following: 'On the evidence presented to or obtained by the committee, it does not recommend any change in Rule 68-d, but presents this report with the understanding that (in order to obtain additional field experience) municipal and underwriters' inspection departments may permit a continuation and extension of the use of such refillable fuses as have in their opinion been shown to comply with the tests specified for standard cartridge fuses and to be suitable for use.'"

CHANGES IN PERSONNEL OF ENGINEERING FACULTIES

Listing of Resignations, Leaves of Absence, Promotions and Appointments in the Electrical Teaching Body of the United States

Owing primarily to the war, either because of national service or because of the call by industry for technically trained men, there have been many changes in engineering faculty personnel throughout the country since the last school year closed. The ELECTRICAL WORLD has undertaken to list these changes so far as they pertain to the electrical engineering departments of these institutions. The following is a partial list of those received up to the present; others will follow in later weeks:

Agricultural and Mechanical College of Texas, College Station, Tex.—Associate Prof. J. H. Cannon has resigned to accept the position of associate professor of electrical engineering at the University of Michigan. Walter C. Smith, who holds a degree of M. S. in electrical engineering from Union College, has been appointed assistant professor of electrical engineering.

Carnegie Institute of Technology, Pittsburgh, Pa.—A. F. Van Dyck, who was instructor in electrical engineering, has resigned to accept the position of expert radio aide in the Brooklyn Navy Yards. His position has not yet been filled. Robert E. Dunbar, who was graduate assistant in the electrical laboratory, has died, and his position has been filled by C. M. Porter of the Westinghouse Electric & Manufacturing Company.

Case School of Applied Science, Cleveland, Ohio.—A. A. Prior, instructor, entered the first officers' training camp at Fort Benjamin Harrison in May and was commissioned as first lieutenant, Coast Artillery. P. H. Ellsworth, instructor, is now first lieutenant in the Signal Corps and stationed at present at Fort Leavenworth, Kan. Because of the great loss of students in the senior and junior classes at the school it has not been necessary to fill the places of these men for the present year.

Drexel Institute, Philadelphia, Pa.—J. L. Beaver, for many years an instructor in electrical subjects, occupying the position of senior instructor in electrical engineering, has entered the engineering department of the Philadelphia Electric Company. No new appointment has been made on account of diminished enrollment.

Georgia School of Technology, Atlanta, Ga.—H. L. Freeman, formerly assistant professor of electrical engineering, has resigned to take a position with the Mississippi Agricultural and Mechanical College. Ben H. Woodruff, formerly instructor, is now first lieutenant in the engineer corps of the United States Army. C. P. Eldred, formerly assistant professor of electrical engineering, head of department, Co-operative School of Engineering, Northeastern College, Boston, has been appointed associate professor of electrical engineering. E. B. Phillips has been appointed instructor in electrical engineering. Other assistants in the department are not yet announced.

Kansas State Agricultural College, Manhattan, Kan.—C. A. Bjorkman, fellow in this department last year, has resigned to enter the army. The college has been unable to find a fellow to fill his place. G. B. McNair, assistant professor of electrical engineering, has been on leave of absence for the past year on account of his health. He resigned this summer to take the place of Prof. George B. Thomas, Colorado College, who is on leave of absence for a year. Prof. R. G. Kloeffler, formerly with the Washington Water Power Company, who was secured to substitute for Professor McNair last year, has been retained as his successor.

Massachusetts Institute of Technology, Cambridge, Mass.—Assistant Prof. Charles W. Green is a captain in the Heavy Artillery Corps, doing special work for the Artillery Board. F. G. Perry, who was instructor, is a captain in the Heavy Artillery. H. B. Richmond, who was instructor, is a first lieutenant in the Heavy Artillery. P. L. Alger, who was a research assistant last year, is a first lieutenant of the Ordnance Corps, working on ballistic research at Sandy Hook. W. B. Littlefield, who was a teaching assistant in the department, is a second lieutenant in the infantry. E. W. Bowler, who was a research assistant last year, is a second lieutenant in the Engineer Corps. W. E. Wynne, who was a research assistant last year, is in the field artillery. J. B. Peterson, who was a research assistant last year, is at a training camp. Other members of last year's staff are instructing in the aviation ground school and the army and navy school, and two others are in research work connected with purely war matters. The three following additional instructors have been added to the staff this year: C. E. Lansil, E. A. Ekdahl and C. O. Gibbon. Prof. W. S. Franklin, who used to be at Lehigh University, has been appointed special lecturer in physics and electrical engineering, giving instruction in both departments.

Ohio State University, Columbus, Ohio.—Dr. A. E. Flowers, who last year was away from the university, on leave of absence, has returned to his university work. Last year he was occupied in connection with the appraisal of the Columbus Railway, Power & Light Company. E. W. Kellogg, who last year filled Dr. Flower's position, is now in the research department of the General Electric Company at Schenectady.

Oklahoma Agricultural and Mechanical College, Stillwater, Okla.—C. J. Moore, instructor, has resigned to accept a commission as second lieutenant, U. S. Reserve Engineers. William Spraragen, an employee of the Westinghouse Electric & Manufacturing Company, was elected to fill the vacancy.

Pennsylvania State College, State College, Pa.—Dr. E. C. Woodruff, professor of electric railway engineering, who was granted a leave of absence in the spring of 1917 to accept a captaincy in the Engineering Officers' Reserve Corps, has been granted an indefinite leave by the War Department and has resumed his duties at the college. George H. Mills, instructor in electrical engineering, has been granted an indefinite leave of absence from the college and is in the ordnance department of the army, stationed at Camp Dix, Wrightstown, N. J. Gordon D. Robinson, instructor in electrical engineering during the college year 1916-17, has resigned and has accepted a position in the engineering department of the Continental Can Company, Baltimore, Md. John D. Isenberg, Pennsylvania State 1902, has been appointed instructor in electrochemical engineering. For some years past Mr. Isenberg has been on the chemical staff of the United States Institute of Animal Nutrition at State College, Pa.

Polytechnic Institute, Brooklyn, N. Y.—As the result of the war the institute has lost Prof. W. D. Ennis, head of the mechanical engineering department, who has become a major in the ordnance department, and Herman A. Brandt, instructor in mechanical engineering, who has become an ensign in the navy. In the readjustment, Henry Martin, Jr., has assumed the instruction in power plants and thermodynamics, and Prof. Samuel Sheldon has been made acting head of the department of mechanical engineering. A number of additional instructors have also been brought into service.

Rensselaer Polytechnic Institute, Troy, N. Y.—J. D. Stacy, E. E., of the class of 1917, has been appointed assistant in electrical engineering to take the place of C. E. Merris, who resigned in June to accept a position in the power and mining department of the General Electric Company.

Sheffield Scientific School of Yale University, New Haven, Conn.—Prof. Harold V. Bozell, who was with the Sheffield school on leave of absence from the University of Oklahoma last year, has accepted a permanent position as assistant professor of electrical engineering. Frank H. Beall has been appointed instructor in electrical engineering. Mr. Beall received a post-graduate degree from the electrical engineering department of Harvard University. He then taught for a year in the graduate school and for the last two years has been in the engineering department of the American Telegraph & Telephone Company in New York. Russell G. Warner, a graduate of this school, who was for two years with the Westinghouse Electric & Manufacturing Company and was last year here as an assistant, has been appointed instructor, giving special attention to the laboratory work.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Insufficiency of Evidence in Overflow Case.—In an action against a company maintaining dams across a river whereby overflowing water damaged plaintiff's crops, evidence was held by the Georgia Court of Appeals insufficient to sustain verdict for plaintiff. Georgia Railway and Power Company versus Johns (93 S. E. 521).

Action for the Violation of a City Ordinance.—An action by a city to enjoin a telephone company from making a threatened increase in its rates or charges, in violation of a city ordinance and in violation of a contract between the city and the company, is not an "action for the violation of a city ordinance" within the law giving superior courts exclusive jurisdiction over actions for the violation of city ordinances, especially where the petition is based upon the alleged contract, rather than upon the threatened contravention of the municipal regulation, the Supreme Court of Iowa held (164 N. W. 168).

Duty of Employers to Maintain Safe Working Place.—In an action for damages for the death of an employee in a mine who came in contact with a hanging electric wire, where the declaration charged that it was the duty of the employer to use reasonable care to maintain the wire in a safe position, an instruction that it was the duty of the employer to use care commensurate with the danger to inspect and maintain the wire was justified, though there was no allegation to that effect, the duty of inspection being an incident to the duty of maintaining the wire, according to the Supreme Court of Appeals of Virginia (935 E. 5901). It was the duty of a mine operator to use reasonable care to make a fallen electric wire reasonably safe after he knew, or by ordinary care might have known, of the defect.

Power to Guarantee Bonds of Other Companies.—A corporation has no power to enter into contracts of guaranty or suretyship, or otherwise lend its credit to another, unless expressly authorized by its charter or by statute, except where the power to do so is implied from its express powers as necessary and proper in the furtherance of its legitimate business, according to the Supreme Court of Illinois (117 N. E. 148). A railroad company which has, in the proper exercise of its powers by law and within the limitations expressed in those sections, purchased stock in another railroad company, and which has in good faith, for the protection of its interests as such stockholder, acquired bonds issued by such other company, has implied power in order to sell such bonds for an adequate price to guarantee their payment. A railroad corporation which is subject to the laws of Ohio has no authority, express or implied, to enter into a joint contract of guarantee by which it jointly with other companies guarantees an entire issue or series of bonds issued by another company of which the Ohio company owns only a portion.

Renewal of Lighting Contract.—Where the subject matter of a suit between a borough and a light company is a contract wherein it is provided that "It is mutually agreed by and between the parties hereto, for themselves and their and each of their successors and assigns, that this contract shall go into effect on the thirtieth day of January A. D. one thousand nine hundred and eleven and shall expire on the thirtieth day of January A. D. one thousand nine hundred and sixteen; provided, however, that the borough may at its option renew this contract for another period of five years from the thirtieth day of January A. D. one thousand nine hundred and sixteen, under the terms and conditions hereof," it was held by the Court of Common Pleas of Northumberland County, Pa., in the Borough of Sunbury, versus Northumberland County Gas & Electric Company (5 P. C. R. 1917—431) (1) that the word "renew" as used in the contract should be construed to mean "to continue" or "extend"; (2) that where the borough elects to exercise its option to renew no additional contract of writing is necessary to continue in force the provisions of said contract; (3) that in such a case the jurisdiction of the equity court is not ousted by the public service act.

Workmen's Compensation in Accident in Plant Not Arising Out of Employment.—In a proceeding under the workmen's compensation act to recover compensation for death, the burden was on the plaintiff administrator to prove that the accident arose out of and in the course of the employment, the Supreme Court of Illinois held in Northern Illinois Light & Traction Company versus Industrial Board of Illinois (117 N. E. 95). In a proceeding under the act, if there is competent evidence in the record which, standing alone, fairly tends to prove that the accident arose out of and in the course of the employment, neither the Circuit Court nor the Supreme Court may question its sufficiency, but whether there is any evidence in the record fairly tending to establish that fact is a question of law for the determination of the court. Where the head fireman of an electric company, in disregard of signs, fences and rules designed to keep persons out of the transformer room of the power plant, entered that room on no business of the company and was there accidentally killed by an electric shock, compensation was not recoverable for his death, although at other times he had frequently been called upon in performing the duties of the engineer to enter the transformer room.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Reservation in Acceptance of Security Issues.—After a hearing before the New York Public Service Commission, Second District, the city of Watertown finally agreed to withdraw objections filed against the proposed bond and stock issue for which the Northern New York Utilities, Inc., is now seeking authority. The city of Watertown, represented by Mayor J. R. Breem, City Attorney H. L. Hooker and F. W. Ballard of Cleveland, Ohio, accepts the suggestion made some time ago by the commission, namely, that an agreement be drawn whereby the city agrees not to block the proposed issue, but on the explicit understanding that such a concession is to have no weight in a rate case which is to be brought up in the near future.

Wisconsin Commission Approves Higher Heating Rates.—Appearing before the Wisconsin Railroad Commission, the Wisconsin Gas & Electric Company asked approval of rates for hot-water heating in Kenosha. The increase in operating expenses in 1917 was shown to be due to the increased cost of fuel, labor and various supplies. It was estimated by witnesses for the company that this increase in cost will continue to a more marked degree in 1918 on account of the war conditions. With the proposed increase in rates the revenue would create a return of 4.19 per cent on the book value of the plant and property. The commission found that the rate for hot-water-heating service in Kenosha proposed by the company is reasonable.

Burden of Proof Put on Complainant.—The Pennsylvania Public Service Commission, in rendering a decision in the case of the North Abington Water Company versus the Abington Electric Company, sets forth that the complainant had a contract with the respondent by which the latter was to furnish electric power to the former at a fixed price. The contract was for a period of one year, to be continued thereafter until discontinued by either party on giving thirty days' notice. Pursuant to the terms of the contract, respondent notified the complainant that it had filed with the commission a new tariff and submitted to the complainant a new contract calling for new rates. The complainant contested the validity of the new rates, declaring them to be excessive, unreasonable and discriminatory. The commission held that since the complaint was filed after the increased rate went into effect the burden of proof was on the complainant; that the evidence submitted did not show excessive or discriminatory rates.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Kentucky Municipal Plant Increases Rates.—High cost of operation is responsible for an advance of about 1 2/3 cents per kilowatt-hour for electric lighting service from the municipal lighting plant of Owensboro, Ky., effective on Nov. 1.

Philadelphia Stock Exchange Approved.—At a special meeting of stockholders of the Philadelphia Electric Company it was announced that the total vote cast was 727,852 shares, all in favor of the plan for exchange of stock of the New Jersey company to the Pennsylvania company. The total number of outstanding shares is 999,510.

Examination for Cable Tester.—The Municipal Civil Service Commission, New York City, has announced an examination for cable tester, paying a salary of $1,140 to $1,380 a year. The duties of the position are to locate leaks and test for electrolysis of cables and to make acceptance tests on and inspections of wires and cables, underground conduits, manholes, accessories, firehouse and public building wiring for alarm systems and poleline equipment. For further particulars apply room 1400, Municipal Building, Manhattan.

Examination for Clerk-Draftsman.—The United States Civil Service Commission announces an open competitive examination for clerk-draftsman, for men only, on Nov. 21 and 22, 1917, at various places. Vacancies in local branches of the General Land Office service, at the entrance salary of $1,200 a year, and in positions requiring similar qualifications at this or higher or lower salaries, will be filled from this examination, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer or promotion. Applicants should apply for Form 1312, stating the title of the examination desired, to the Civil Service Commission, Washington, D. C., or to the secretary of the United States Civil Service Board at a number of cities.

Two Power Rates Encourage Pumping for Irrigation.—In the Perris and San Jacinto Valleys in southern California the area under cultivation has been greatly increased recently by the use of motor-driven pumps which supply water for irrigation. The operation of gasoline engines formerly used for pumping has been made too costly by the steadily increasing price of fuel oil, and this led to the substitution of the electric motor for the gasoline engine. With the success of electric pumping thus exploited there was a rapid increase in the power companies' business. At present approximately 10,000 hp. in electric motors is being used in these two valleys. Two types of pumping developments have been installed, one of which, of large capacity, is used to supply the lands at irregular intervals and is assigned consequently a high rate for power. The smaller installations, using small motors and running continuously to supply reservoirs, thus earn a low power rate.

Increased Heating Rates.—The *Bulletin* of the National District Heating Association dated Oct. 15 contains a lengthy compilation of heating rates. In the last issue of the *Bulletin* and at the convention in Detroit strong emphasis was put on the question of increasing the rates and every one was urged to protect plants by increasing rates to cover the increased cost of service. The compilation is based on information from companies showing what action they have taken in raising rates.

Christmas Remembrance for Army Engineers.—The ladies' auxiliary of the Twelfth Engineers, which has drawn a large percentage of its membership from St. Louis and vicinity, is undertaking to see that each member of this regiment receives a Christmas present. A committee from the Engineers' Club of St. Louis has conferred with the committee from the ladies' auxiliary and has agreed to furnish a part of each package. Each individual package will contain candy, a magazine, a "housewife" and tobacco. The Engineers' Club is to furnish 1000 packages of tobacco. Clinton H. Fisk is chairman of the Christmas package committee.

Briefs in Boston Edison Street-Lighting Case.—Counsel for the Edison Electric Illuminating Company of Boston, Mass., and the city of Boston filed briefs with the Gas and Electric Light Commission Oct. 22 in the celebrated street-lighting rate case which was brought before the board for arbitration about three years ago and which has occupied 122 days of public hearings in the last eighteen months and embraces nearly 10,000 pages of testimony. Corporation Counsel John A. Sullivan presented a brief of 217 pages on behalf of the city, and Burdett, Wardwell & Ives of Boston, represented by Frederick Manley Ives, filed a brief of 265 pages on behalf of the company. Arguments on the basis of the two briefs have been going forward each day this week, the case of the city being presented first. Both parties have prepared printed briefs, and the documents summarize the direct testimony at much length, besides reviewing the points made in cross-examination. The fundamental question is whether the rates in the contract are as a whole fair. The contract (life ten years) dates from Dec. 7, 1914, and involves a street-lighting revenue of over $500,000 per year. The chief basic items of interest covered by the service are 4543 6.6-amp. magnetite-arc lamps at $87.53 per year each; 2910 40-cp. and 1157 60-cp. series incandescents at $18.333 and $21.136 respectively.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 893 of this number.

Worcester Polytechnic Institute Section of the A. I. E. E.—"Summer Experiences" was the subject of the first regular meeting of the Worcester Polytechnic Institute Section of the A. I. E. E., held Oct. 26.

Jovian Electric League, Los Angeles.—At the Oct. 17 meeting of the league the speakers of the day were Secretary of the Treasury McAdoo and Prof. Laird J. Stabler of the University of Southern California.

Associated Electrical Contractors, Inc., Elect Officers.—At the annual meeting of the Associated Electrical Contractors, Inc., New York City, the following officers were elected: President, H. M. Walter; vice-president, B. W. Sandbach; treasurer, J. W. Flint; secretary, H. S. Beidleman; sergeant-at-arms, B. J. Anderson.

Training of Engineers.—Prof. A. C. Lanier, chairman of the department of electrical engineering of the University of Missouri, delivered a paper on "Some Comments Upon the Training of Engineers" at a joint meeting of the St. Louis Section of the American Institute of Electrical Engineers and the Associated Engineering Societies of St. Louis, on Oct. 24.

The Electric Club as a Factor in the Progress of Dallas.—The Dallas Electric Club and Jovian League held its first meeting this fall on Oct. 15. Fred M. Lege, vice-president and general manager of the Dallas Light & Power Company, spoke on the subject of the Electric Club as a factor in the progress of Dallas. Adam H. Davison gave a five-minute talk on "The Allegiance of the Electrical Fraternity to the Buy-a-Home Movement — the Contractor's Viewpoint."

New York Section of the I. E. S.—The next meeting of the New York Section of the Illuminating Engineering Society will be held at the Engineering Societies Building Nov. 8, at 8 p. m. Two papers will be presented which are of general interest to public utility men. The first of these is entitled the "Illuminating Engineering as a Commercial Force," prepared by a committee of the Lighting Sales Bureau, National Electric Light Association, consisting of Messrs. Hogue, Law and Whitehorne. The paper treats of illuminating engineering as a basis of central station practice—the purposes of illumination engineering, first, in developing new customers; second, in interesting prospective customers; third, in promoting satisfaction to customers, with examples. The second paper is on "Value of Illuminating Engineering to the Gas Industry," by Robert Pierce.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Arthur Williams, general commercial manager of the New York Edison Company, was appointed on Oct. 24 federal food administrator for New York City to work in co-operation with various committees and commissions and the federal agent for the State in the solving of the food problems of the city. Mr. Williams is well known throughout the electrical industry. He was born at Norfolk, Va., on Aug. 14, 1868, and after having received his education at the private and public schools of Hartford, Conn., and New York City, entered the electric lighting industry in

ARTHUR WILLIAMS

New York City in 1885 as assistant in the chemical meter department. Since that time Mr. Williams has been constantly affiliated with the electric lighting interests in New York City. He was superintendent of interior construction in 1887, electrician for the company, then operating only the Pearl Street station, in 1887; superintendent of the third district in 1888, superintendent of underground department in 1889, general inspector in 1890, general agent in 1893, and is now general commercial manager. Mr. Williams has a wide connection with the national electrical associations, being a past-president of the National Electric Light Association and of the Association of Edison Illuminating Companies. He was at one time vice-president of the Electric Vehicle Association of America, now affiliated with the N. E. L. A. as a section. He is past-president of the New York Electrical Society and past-president of the American Museum of Safety, besides being a member of a number of other associations. Mr. Williams has been decorated by both the French and Spanish governments, in the latter case in recognition of his work in the interests of safety. Mr. Williams has also had military experience, having served as an officer in charge of mine laying in the New York harbor during the Spanish-American war.

E. S. Myers, formerly electrical engineer of the Fort Wayne & Northern Indiana Traction Company, has become connected with the Vicksburg (Miss.) Light & Traction Company.

M. N. Weeks has succeeded C. G. Gross as superintendent of the municipal electric light and water plant at Grand Rapids, Wis.

James E. Hunt has been promoted to superintendent of stations A-1 and A-2 of the Philadelphia Electric Company, succeeding N. Ewell Funk.

N. Ewell Funk, formerly superintendent of stations A-1 and A-2 of the Philadelphia Electric Company, has been promoted to be assistant operating engineer.

George Buttrick, formerly superintendent of overhead work for the Bridgeport Division of the Connecticut Company, has been appointed superintendent of line construction for the Republic Railway & Light Company, Youngstown, Ohio.

A. J. Neff, who has had some eighteen years' experience in the operation, maintenance and construction of public utilities, has recently become a member of the engineering force of the General Engineering & Management Corporation, New York City, as efficiency engineer. Mr. Neff has devoted the last four years to efficiency work, having been efficiency engineer for the American Public Service Company, operating properties in Texas and Oklahoma, for the last two years. He also had charge of all improvements and construction pertaining to the power plants for this company the last year.

Sam A. Hobson, who for the last five years has been Western manager of the ELECTRICAL WORLD, has resigned, effective Jan. 1, 1918. Mr. Hobson's acquaintance in the electrical industry in the United States, due to his years of commercial association with it, is perhaps as wide as that of any individual. His work has brought him into intimate contact with every branch of the electrical business. He has handled construction and operation of electric light and street railway companies; he has been an electrical contractor; he was in the jobbing business; he worked in the sales end of a manufacturing company, and lately he has been employed in the electrical publishing business. Mr. Hobson's first work in the industry was performed for the Wyatt Park Street Railway Company of St. Joseph, Mo., one of the earliest electric railways in the country. His construction experience gained there was later utilized in superintending the building and operation of the Electric Railway & Light Company of Waco, Tex., from 1891 to 1895, of the Electric Railway Company at Atlanta, Ga., and later of the Mutual Electric Light & Power Company of San Antonio, Tex. For a short time he was in the electrical contracting business in Waco and Austin, Tex. From 1897 to 1907 he was sales manager of the Hobson Electric Company, Dallas, Tex., where he did his full share, working with his two brothers to bring that concern from a struggling little supply house to a really great commercial institution in the Southwest. It was during his association with this company that he assisted in founding the Jovian Order and became its third reigning Jupiter. From 1907 until 1911 he was manager of the apparatus department of the Wesco Sup-

S. A. HOBSON

ply Company of St. Louis, leaving that position to become manager of the St. Louis office of the Fort Wayne Electric Works. On Dec. 1, 1912, he was made Western manager of the ELECTRICAL WORLD, with headquarters at Chicago. In addition to his Jovian work in Texas, Mr. Hobson has been active in other states. He was one of the founders of the St. Louis League of Electrical Interests, the local Jovian organization, which has helped to develop trade harmony where utter lack of it formerly existed. This is typical of his service to the industry through the Jovian Order. In the sales field Mr. Hobson's personality and knowledge of the industry have made the men to whom he has sold friends as well as customers, and he will bring this great asset into the new work he has chosen. Mr. Hobson is planning to re-enter actively his favorite field—the merchandising of electrical apparatus. He carries with him the best wishes of the McGraw-Hill Publishing Company.

Obituary

Percy L. Cobb, for the past year an electrical engineer with the Interstate Commerce Commission, division of valuation of railroads, died on Oct. 11 at Portland, Me., of typhoid fever. Mr. Cobb, who was a graduate of Stevens Institute of Technology, was at one time connected with the New York, New Haven & Hartford Railroad and with the Pennsylvania Railroad as instructing electrical engineer.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

NEW INCANDESCENT LAMP CONTRACTS ARE IN FORCE

Provisions Against Price Increase Contingency Are Made by Stipulating the Dates on Which Advance Can Be Made

On Thursday of this week the new contracts for the purchase of Mazda incandescent lamps went into effect. For the first time provisions are made against the contingency of prices having to be advanced. Formerly it was taken as a matter of course that any change in lamp prices would be downward. Manufacturing conditions, however, have changed to such an extent in the last three years that, except for a downward revision of the 50-watt size, when the demand had reached a predetermined volume, manufacturers have been able only with great difficulty to keep prices from advancing. Glass, chemicals, and labor have been a constant source of worry. Production economies have been made and have enabled the manufacturers to date to sell at the same prices, but the profits have been much smaller.

Rumors are now strong in the trade that higher prices on lamps can be expected with the new year. At any rate, provisions are made so that an increase can take place on Jan. 1, 1918, if conditions warrant it.

According to the contract for purchases advances will be effective only as of Jan. 1, April 1, July 1 or Oct. 1. It is further agreed that whatever changes are made the net price to the purchaser for any lamp purchased under the contract shall not exceed present schedules by more than 10 per cent.

All lamps billed after the date on which increases become effective will be billed at the higher rate, except that orders for immediate delivery which do not exceed the normal requirements of the purchaser for one month will be filled on the basis of prices prevailing on the date of acceptance of the order, even though delivery be delayed beyond the date of advance in price.

This contract is only for purchasers—*i.e.*, central stations, isolated plants, etc.—not dealers.

OUTPUT OF LUXURIES MAY BE RESTRICTED

Two Courses Have Been Discussed Which Would Through Coal Supply Regulation Curtail Production of Goods Not Essential to War

The fears of manufacturers of certain classes of electrical goods that the federal government might take some action similar to that taken by Great Britain in restricting the production of goods not essential to the war and employing raw material and labor that are needed for war supplies may be realized. A report emanating from good authority in Washington last week states that restriction of production of materials not essential to the war is under serious consideration by President Wilson and action may be taken soon.

Although there has been no intimation of the exact nature of any step contemplated by the President, two courses have been generally discussed. Under one the War Industries Board would enter into voluntary agreements with specific manufacturers of non-essentials to reduce their output gradually. Under the other the President would issue a general request to manufacturers and rely on their patriotism to follow the suggestion.

The power behind both plans, it is stated, would be the government's authority to hold up coal shipments to recalcitrant producers and to control transportation through the priority director of the War Industries Board.

Agitation for measures to stop the use of many kinds of materials required for war purposes in production of luxuries or other articles not contributing to war needs has been started among many government officials, it is stated in the Washington report.

The problem involves many difficulties, particularly in determining just what materials are to be considered nonessential. Advocates of the exercise of strong powers believe, however, that a list of products the manufacture of which might be dispensed with largely during the war could be formed to meet public approval.

DEALERS MUST GIVE CHILD LABOR GUARANTEES ON GOODS

New Federal Act Requires Person Putting Goods in Interstate Commerce to Guarantee Them to Be Manufactured in Accordance with Law

By the provisions of the federal child labor act, which became effective Sept. 1 last, all dealers and manufacturers of goods parts of which, whether all or some, are purchased from other manufacturers must, before placing goods in interstate commerce, obtain from the manufacturers of such goods or parts signed guarantees that such goods or parts were produced or manufactured in an establishment in which within thirty days prior to the removal of such goods therefrom no children under the age of fourteen were employed or permitted to work, nor children between the ages of fourteen and sixteen were employed or permitted to work more than eight hours in any day or more than six days in any week, or after the hour of 7 p. m. or before 6 a. m.

Rules and regulations heretofore issued specify only the guarantee to be supplied by the manufacturer. Now the dealer to engage in interstate commerce must give a guarantee. The following form of guarantee, according to an opinion just issued by the Children's Bureau, will be sufficient to protect the dealer:

"I, the undersigned, do hereby guarantee that the articles or commodities listed herein (or specify the same) were purchased by me under a guaranty by the manufacturer or producer that they were produced or manufactured in a (mill, workshop, factory or manufacturing establishment) in which within thirty days prior to the removal of such product therefrom no children under the age of fourteen years were employed or permitted to work, nor children between the ages of fourteen years and sixteen years were employed or permitted to work more than eight hours in any day or more than six days in any week, or after the hour of 7 o'clock p. m. or before the hour of 6 o'clock a. m. (Name and place of business of dealers.)"

For products of mines or quarries the dealer will use the following guarantee: "I, the undersigned, do hereby guarantee that the articles or commodities listed herein (or specify the same) were purchased by me under a guaranty from the producer that they were produced in a mine or quarry in which within thirty days prior to removal of such product therefrom no children under the age of sixteen years were employed or permitted to work. (Name and place of business of dealer.)"

Very nearly similar forms of guarantee are provided for one supplying both goods of his own manufacture and of other manufacture. Copies of these opinions may be had

by applying to the Children's Bureau, Department of Labor, Washington, D. C.

A commission agent is considered in this connection as a dealer and therefore must place his guarantee as a dealer on all goods which he shall hereafter place in interstate commerce.

WIRING REQUIREMENTS OF SHIPPING BOARD

Quotations and Delivery Dates Desired on Miscellaneous Equipment, Including Tape, Solder, Flux, Contactors, Conduit, Etc.

The United States Shipping Board Emergency Fleet Corporation, Washington, D. C., sent out notices this week requesting quotations and delivery dates on all or any part of the following miscellaneous wiring material:

Item	Quantity	Article
1	1250 lb.	Friction tape, ¾ in., black Manson or equal.
2	2500 lb.	Rubber tape, ¾ in., Okonite or equal.
3	750 lb.	Solder, half and half, ½-lb. bars.
4	250 lb.	Soldering flux, first grade, 4-oz. containers.
5	250	Door contactors (door switch), brass, substantial.
6	500	Slip sleeves for 1-in. conduit.
7	500	Slip sleeves for ½-in. conduit.
8	2500	Grounding clamps with lugs, for 1-in. conduit.
9	5000	Grounding clamps with lugs, for ½-in. conduit.

Slip-joint fittings of items 6 and 7 are to be as shown by sketch on page 1825 of the Sept. 16, 1915, "Transactions of the American Institute of Electrical Engineers"—an article entitled "Standard Marine Electrical Installations" (Horner).

Bidders are to state the lineal feet per pound of the tape and rubber gum which are proposed.

Unit shipments are to consist of one two-hundred-and-fiftieth of the aforesaid quantities. Deliveries are to start about Dec. 1, 1917, and are to continue uniformly until July 1, 1918. Either samples or complete specifications are to be submitted with proposal. Name of manufacturer and point of manufacture and delivery are to be stated in proposal.

METAL MARKET SITUATION

Aluminum, Lead and Brass Weaker in Price During Last Week

Slight changes have occurred in aluminum, which is a point lower. Lead is also lower, likewise wire base. Brass is softer, but tin is tending upward. The demand for all metals continues active, with the buying generally restricted to immediate needs or necessary requirements.

The prevalent feeling among buyers is extremely unsettled, and prices on finished goods are governed by the fluctuations in the metal market, which is being closely watched. That the peak has been reached, however, is the general belief.

NEW YORK METAL PRICES

	Oct. 22	Oct. 29
	£ s d	£ s d
Copper:		
London, standard spot	110 0 0	110 0 0
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	30.00 to 32.00*	29.00 to 31.00*
Lead, trust price	6.50	5.50
Nickel, ingot	50.00	50.00
Sheet zinc, f.o.b. smelter	19.00	19.00
Spelter, spot	8.05 to 8.17½	7.80
Tin, Straits	61.50	64.50
Aluminum, 98 to 99 per cent.	35.00 to 37.00*	34.00 to 36.00

OLD METALS

Heavy copper and wire	22.00 to 23.00	22.00 to 22.50
Brass, heavy	14.00 to 16.00	14.00 to 16.00
Brass, light	11.00 to 11.25	10.50 to 11.00
Lead heavy	5.25 to 5.50	4.75 to 4.87½
Zinc, old scrap	5.50 to 5.75	5.00 to 5.50

*Nominal.

THE WEEK IN TRADE

A SLIGHT building revival was noted last week in certain sections of the country. This is expected to become greater. The Italian situation has had a disturbing effect on trade because of the part it may play in delaying peace. The financial market has been depressed as a result and the credit effect is expected to be somewhat unfavorable.

Prices are still firm. Shipments east are meeting with delay in transportation. Collections are still good.

NEW YORK

Prices showed no change in standard supplies during the past week, and demand was about the same. Deliveries are being delayed on certain items owing to transportation congestion. The new lamp contracts went into effect on Thursday. Higher prices are looked for next year by the trade, but the contracts stipulate that the prices for next year shall not be more than 10 per cent greater than those now in force.

A slight revival in building is reported by the Dow Service Daily Building Reports. A study of prices made in cooperation with this bureau showed that building costs to-day are not more than 30.7 per cent over costs ruling in 1914-15, rather than 50 to 60 per cent, as generally believed. As this information gradually is impressed upon builders it is believed that more and more new construction will be undertaken. The revival noted this week was almost all work that had previously been abandoned because of high prices.

Collections are good and credits getting stricter.

LAMPS.—In the standard sizes of lamps the supply in general is reported as ample and deliveries are better than before, shipments going forward within thirty days. At least 98 per cent of the orders accepted for September delivery by one manufacturer were filled within the specified time. A shortage in miniature lamps still exists, caused by the commandeering of the entire output of the factories by the War Industries Board, and no betterment is looked for within thirty or sixty days. In the new contracts for the coming year authentic advices are to the effect that prices for 1918 will not be advanced beyond 10 per cent, effective Nov. 1. Such increases, if made, are to be graduated and at quarterly intervals. The government, through the War Board, has prohibited the use of lead, which toughens the bulb, in the manufacture of lamps, and unless some successful substitute is discovered and applied the percentage of breakage is expected to be heavier than it has been in the past.

LOCUST PINS.—Conditions in locust pins are exceedingly acute. They are unprecedentedly scarce. There is a tendency to raise prices sharply, and the situation is disturbing. Manufacturers who have contracts to fill are asking for an increase over the agreed-upon figure, to meet the demands of labor and other unavoidable contingencies. Quotations for pins are so varied that the market is hazardous. Freights to Eastern seaboard points are also a disturbing element.

GLASS INSULATORS.—Another advance of possibly 15 per cent is anticipated before Jan. 1. Insulators are scarce and at present quotations orders are being placed by jobbers and distributers as rapidly as acceptances are closed. Skilled labor and material are bothering factories. One manufacturer is advising correspondents that, in the item of fuel alone, as against $1.10 last year, he was obliged to place his contract for 1918 at $4.10 a ton.

CHRISTMAS OUTFITS.—This year the Christmas-tree lighting outfit includes lamps. This is a new practice that will be generally followed. Previously only a few companies furnished the equipment complete. Considerable interest is being shown by buyers, inquiries being lively and far in excess of the previous season, but trade so far is

slow. No change in prices is noted and deliveries are prompt.

FANS.—All prices were withdrawn on Sept. 20, and new figures will be ready by the first of the year, if not earlier. A scarcity of fans for 1918 is freely predicted by concerns in a position to know.

FLASHLIGHTS, ETC.—Competition in flashlights is more in evidence and is more acute than at any time heretofore. More and different grades of this merchandise have been placed on the market, but no marked changes in prices or discounts have occurred on this account. The new arrivals are in a class by themselves and have created their own field in their own way. Deliveries are up to expectation—that is, fair.

SOCKETS.—Possibly some concessions may be allowed by jobbers, who had stocked up earlier on better than prevailing prices; but the manufacturers hold a different attitude. They are holding firmly to existing quotations, and while no advances have been made, the local trade is finding it difficult to figure on the future or to determine what may happen both as to supply or prices. Deliveries are rated fair and the outlook is brightening.

COLLECTIONS AND CREDITS.—Collections are ruling firm, with the result that the customarily classed delinquent is about eliminated. There is no disposition to allow for any other arrangement than for the prompt settlement of bills.

PIPE.—Deliveries in some sizes are satisfactory. Large sizes are reported as being impossible to obtain. Freights from Pittsburgh east are causing the stringency, and L. C. L. shipments to New York City and vicinity are causing no end of trouble.

SHIPMENTS.—Shipping conditions in the metropolitan district, especially in New York City, are described as worse than anything ever before experienced. The difficulty of reaching freight terminals for outgoing shipments is represented as exasperating beyond record.

CHICAGO

The probable effect of the defeat of the Italian armies upon the minds of buyers and the increasing number of incidents which tend to show the workings of the government's priority regulations seem to be the topics of greatest interest in the trade at Chicago. It is expected that the Italian retirement will have the psychological effect of convincing the public in general, including buyers, of the probability of at least two years more of war. Had the recent battles on the Italian front gone favorably to the Allies, practically every one would have expected cessation of the war this winter, as opinion already had that trend. Actual incidents which show that manufacturers are being compelled completely to interrupt shipments of steel and copper or to divert them to government channels are becoming more and more numerous. It seems to be a well-established belief that the middle of November will see this factor taken very seriously into all calculations involving the use of basic materials. In the jobbing trade the business for October is reported to be a little better than it has been. Larger manufacturers state that conditions in the trade are about normal, but that public utilities are buying a trifle more freely owing to the fact that their meager stocks are being depleted by necessary construction. Practically all buying is still on a hand-to-mouth basis in the contractor-dealer field as well as in the public utility field. Credit and collections remain about the same.

COPPER WIRE.—Copper wire is scarce. Some mills are refusing to quote on certain sizes, especially cord. Practically all quotations are hedged with a statement that withdraws the quotation in case the mill cannot get copper.

CONDUIT.—There is some uncertainty in the conduit market. Some have thought the price would go down. Inquiries among the manufacturers show that they have no conduit on hand. The demands for other types of pipes are keeping the mills exceedingly busy. The probability is that the future will see delivery more than price the prevailing factor in conduit purchases. There is little probability of the conduit mills' steel supply being cut off, but there is reason to believe that the output of these mills might be products other than conduit.

GOVERNMENT BUSINESS.—Commercial concerns are advising customers who want goods for government purposes to give the government requisition order numbers on ordering materials for this national work. For example, a jobber placed an order with the mill for copper wire, specifying merely that it was government business. The quotation was sixty days. Later the jobber wired the mill the requisition numbers on its government orders, and the delivery was cut to seven days. The mill had on hand government copper out of which it could fill orders carrying government requisition numbers. Even the railroads give precedence to packages with government requisition orders stamped outside.

POLE-LINE HARDWARE.—The demand is steady and the supply has not yet been affected by priority regulations, although it is easy to see how this might happen.

TRANSFORMERS.—Deliveries from six to twelve months are being quoted.

CHRISTMAS TRADE.—A few early orders continue to come in.

BOSTON

Jobbers report continued activity, with collections fair and no price changes during the last week. The advance of the United States more and more deeply into the war dominates all other affairs, and government orders, combined with actual requisitioning of products en route through the factories, are creating much uncertainty in the industrial field. Deliveries are a little better in the small-motor field, and here and there some effort is being made to establish stocks for immediate shipment. There is little expectation, however, of lasting success in this direction. It cannot be said that the government price-fixing program has as yet stabilized the market. Central stations are hard pressed to take care of business offered, and the coal situation is threatening for the smaller companies. The government, however, seems inclined to take drastic action if necessary to insure a fuel supply to utilities serving industrial plants engaged on war orders, but time is required to accomplish the necessary work involved in getting the coal from the mine to the consumer. The demand for appliances continues strong. Owing to mild weather, it has been possible to accumulate a substantial stock of electric radiators for immediate delivery from the jobber's stock.

SMALL MOTORS.—Single-phase repulsion-type motors show decided improvement in deliveries, and stocks are being accumulated in irregular sizes. On most types of motors, however, long deliveries are the rule, twenty to twenty-four weeks being a common tender. Rush orders for government service are being handled in from one-third to one-half this time, under favorable conditions. One large concern normally carrying 500 motors in its storehouse succeeded in reaching 350 last week, but the condition was only temporary, and there appears to be little or no reduction in demand. Prices remain firm.

PROJECTORS.—Buying of floodlights to round out the protection installations of industrial plants is noted. At the outbreak of the war the demand for this equipment was very heavy and applications were made hastily. Evidences of more engineering attention are now to be seen in traveling through New England, and this means a certain amount of additional but discriminating trade. Stocks are low and the demand is vigorous.

MOTOR GENERATORS.—Equipments for battery-charging service show moderate improvement in deliveries.

TRANSFORMERS.—Priority considerations control the market, and improvements in deliveries reported from some other sections are not reflected in New England.

POLE-LINE HARDWARE.—Jobbers are overstocked and the demand is very small at present. Better conditions are looked for after Jan. 1.

WIRING MATERIAL.—Isolated plant extensions are active, causing a substantial volume of trade. Consumption is low in small knob-and-tube material. Banks are hesitant

regarding loans for the erection of low-cost residences, and the outlook for the rest of the year is continued dullness.

FIXTURES.—Demand is increasing, prices remaining firm. A large amount of reconstruction and renovation work is under way, and prospects favor holiday trade.

TEXTILE MOTORS.—Business is active, and one central station reports an 800-hp. contract for tire fabric production.

ATLANTA

The electrical interests of this section were very active last week in their support of the second Liberty Loan flotation. The Southeastern Section of the N. E. L. A., which held its annual meeting at Birmingham, Ala., strongly indorsed this movement.

There is no apparent let-up in industrial construction, but residence building permits show a small decrease. Notwithstanding this latter feature, the volume of sales, especially through the jobbers, remains about the same, and on the whole there is very little change in general business conditions since last week.

Contracting business, exclusive of government work, seems to be slowing up, but the prevailing opinion is that this condition is only of a temporary nature.

Contractors' collections are good and very little financial trouble is noted in this branch of the industry.

INSULATORS.—This line continues comparatively steady, with a slight decrease in demand from street railways. A number of large shipments covered by past orders are beginning to arrive. Although the manufacturers report a betterment of the labor situation, this factor is offset by the difficulty in securing clays, and no improvement is noted in deliveries.

ELECTRIC HEATERS.—During the last cold spell, before arrangements had been made for winter heating, considerable activity was shown in this line, but the demand has slackened off to a few inquiries from industrial sources. No difficulty has been experienced in supplying the demand from local stocks.

ELECTRIC RANGES.—There is no doubt that the South is taking more interest in electric ranges and in cooking by electricity. It has always been recognized that the education of domestic labor in the South to the uses of electrical appliances has been a difficult proposition, but the successful operation of the ranges already installed has convinced a portion of the buying element. One large manufacturer with point of distribution at Atlanta reports the sale of a number of ranges throughout the South during the past few months, and up to date the sales in this line are showing a substantial increase over 1916.

ELECTRIC IRONS—The demand for irons is excellent, and all the manufacturers are enjoying a good trade. Local stocks are in pretty fair shape and shipments coming in from day to day are replenishing stocks that might otherwise become depleted.

SEATTLE

Intense interest in the culminating week of the second Liberty Loan campaign overshadowed general business activity to the slight impairment of the trade totals that have marked the preceding weeks. Business was featured by a noticeable increase in buying from both steel and wooden shipyards, following the end of the strike of employees, noted last week. This buying was not considered new business, but merely recovered business. However, considerable new business was forthcoming during the week, buying from new industrial plants and lumber mills being noticeably increased. Operations in Seattle shipyards are nearly at normal, and Portland plants report like conditions, following the return of the striking employees.

Electrical dealers report a noticeable increase in buying from the lumber mills, and this condition is expected to obtain until the holidays, when plants usually close down for two weeks and make needed repairs and extensions. It is thought probable, owing to war conditions and heavy orders, that this custom will not be generally observed.

The local dealers report continued shortages in the larger sizes of lamps, rubber-covered wire, conduit, large motors and heavy wire, and an increasing demand for lamps of all sizes, and conduit and energy-consuming devices, particularly washing machines, flatirons, heaters and ranges. The campaign being conducted locally is justifying the most optimistic predictions. Inquiries and orders are surprisingly heavy. One large dealer states that the sale of domestic appliances, especially washing machines, irons and labor-saving devices, has never been heavier. The prices on appliances for the home remain firm. Stocks are in fair condition, and orders are coming through from Eastern factories quite satisfactorily. Larger electrical equipment, particularly motors, transformers and the like, is coming through very slowly. Prices are firm and stocks are all but depleted. There has been no noticeable increase in prices along any line for some time, and dealers do not anticipate any, saying that the peak has been reached.

There is a shortage of labor and the situation is becoming more acute. A slight relief in car shortage in Oregon is noted. The Washington condition, however, is tightening.

Ordering for the Christmas trade continues heavy. Local dealers report considerable business with the government in pick-ups to be furnished to the Bremerton Navy Yard and the American Lake cantonment; also sales of pole-line material, including transformers, insulators, etc., to the local municipal utility company. An eastern Washington power and light company is reported to have placed recently large orders for wire poles and pole-line material for improvements and considerable extension work.

As a whole dealers report credits good and collections very satisfactory.

SAN FRANCISCO

There is discussion of the objectionably low figure of 200 hp. which was the installed capacity measure established years ago of the "large user" to whom a 10 per cent discount should be quoted. The time has long passed, it is claimed, when this figure should have been raised to, say, 1000 hp. This is believed fair under present conditions and would take off the manufacturer's books considerable business which he would be glad to see the dealer or contractor get. However, no action on this has yet been definitely taken.

Little construction is under way, and orders for new stock and equipment are delayed. There is normally a coastwise exchange of stocks between the Seattle, San Francisco and Los Angeles branches of the larger electric companies, but of late the shortage of bottoms for freight shipments by water has made necessary the more expensive rail shipment, and this has accentuated shortages.

Shipbuilding orders of the larger class continue to come in in undiminished quantity for delivery about two years hence.

LAMPS.—The demand for lamps is so strong that it is believed there is considerable overbuying, induced by the difficulty of getting large quantities.

PUMPING EQUIPMENT.—The demand for irrigation pumping equipment is strong in some quarters. One power company reports an application from central valley sources for a 3000-hp. pump to be used next season for this purpose, provided consumers can get equipment by that time.

SWITCHBOARD DEVICES.—There seems to be some shortage in this line. Meters, circuit breakers and switches are in demand, and deliveries are slow.

SAFETY DEVICES.—As the National Electrical Safety Code becomes better known the demand develops correspondingly for safety devices. Motor-starting switches particularly are in this class.

SMALL MOTORS.—A falling off in the demand for small motors is attributed to the close of the irrigation season, and also to the fact that power companies have probably reached the limit of their ability to release transformers here and there in order to supplement depleted transformer stocks. There is now felt on the Pacific Coast the tendency to slower motor deliveries because of increased government demands on the factories. Last month small motor stocks were improving, but this is not true at present.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List, per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 Solid.
Less than coil .....+10% to List Net
Coil to 1000 ft.....—10% to $59.17

No. 12 Solid.
Less than coil .....+10% to List Net
Coil to 1000 ft.....—10% to $68.87

Twin-Conductor

No. 14 Solid.
Less than coil.....List Net to $105.00
Coil to 1000 ft.....$70.00 to 10%

No. 12 Solid.
Less than coil.....List Net
Coil to 1000 ft.....10% to $130.95

DISCOUNT—CHICAGO

Single-Conductor

Less than coil.....+10%
Coil to 1000 ft.....—10%

Twin-Conductor

Less than coil.....+10%
Coil to 1000 ft.....—10%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....10% to list net
1/5 to std. pkg.....15% to 20%
Std. pkg. .....28% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....+20% to 12%
1/5 to std. pkg.....List to 20%
Std. pkg. .....28% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 30	.35	.35
50 to barrel	.31 to .3175	.32 to .3275
Barrel lots	.28 to .2875	.29 to .2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. Per Coil	List, Per 100 Ft.
5/16	250	$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25–50	35.00
2	25–50	45.00
2 1/2	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp.	$75.00	$63.75 to $69.75
3/8-in. d. stp.	75.00 to 82.50	68.25 to 75.00
1/2-in. s. stp.	100.00	85.00 to 93.00
1/2-in. d. stp.	100.00 to 110.00	91.00 to 100.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 100 Ft.
3/8-in. single strip	$75.00	$63.75
3/8-in. double strip	78.75	71.25- 71.27
1/2-in. single strip	100.00	85.00
1/2-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32	$0.05 1/2	1	$0.25
1/4	.06	1 1/4	.33
3/8	.09	1 1/2	.40
1/2	.12	1 3/4	.47
5/8	.15	2	.55
3/4	.18	2 1/4	.65

NET PER 1000 FT.—NEW YORK

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—		
$25.00-$55.00	$20.50-$24.75	$20.00-$22.00
1/4-in.—		
$28.00-$60.00	$22.50-$27.00	$22.00-$24.00

NET PRICE 1000 FT.—CHICAGO

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—		
$36.69-$55.00	$27.50	$24.75
1/4-in.—		
$40.00-$60.00	$30.00	$27.50

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4	$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37
2 1/2	.58 1/2
3	.76 1/2

	Couplings, List	Elbows, List
1/4	$0.05	$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.60
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb..	4% to 6%	7% to 9%
2500 to 5000 lb....	6% to 9%	9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	2.8% to 3.4%	5.4% to 5.8%
2500-5000 lb	6.4% to 6.8%	8.4% to 8.8%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price .....$5.00 to $6.00
Discount .....25% to 30%

CHICAGO

List .....$5.00 to $6.00
Discount 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....28%
1/5 to std. pkg.....38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....28%
1/5 to std. pkg.....38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK.

	Per 100 Net
Less than 1/5 std. pkg.	$5.00 to $5.75
1/5 to std. pkg.	4.50

Standard package, 500. List, each, $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$6.25
1/5 to std. pkg.	5.25

Standard package, 500. List, each, $0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B	100	$0.27
60-watt—B	100	.36
100-watt—B	24	.65
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00
Round bulbs, 3½ in., frosted:		
15-watt—G 25	50	.50
25-watt—G 25	50	.50
40-watt—G 25	50	.50
Round bulbs, 3¾ in., frosted:		
60-watt—G 30	24	.72
Round bulbs, 4¾ in., frosted:		
100-watt—G 35	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00 to $33.98
Coil to 1000 ft.	25.50 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$36.24 to $36.56
Coil to 1000 ft.	27.18 to 27.42

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	$20.00 to $29.00

CHICAGO

Net per 100	$19.25

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200 S.E., 300, AX, 1½, 4 S	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S. 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25%-37%	20%-32%
$10.00 to $50.00 list.	42%-45%	37%-40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$15.00 to $38.00
1/5 to std. pkg.	13.60 to 19.00

Standard package, 2200 List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80 to $20.54
1/5 to std. pkg.	14.80 to 19.24

Standard package, 2200 List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 5½ N.C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$20.00 to $29.00	$23.20 to $30.75
1/5 to std. pkg.	13.50 to 15.60	18.70 to 24.20

CHICAGO

Per 1000 Net	Std. Pkg. 3500 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 5½ N.C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$11.85	$30.75
1/5 to std. pkg.	11.10	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
⅛-in. cap key and push sockets	500	$0.33
¼-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std pkg.	Net
1/5 to std. pkg.	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. R. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	List net to + 5%
$10 to $25 list	11%
$25 to $50 list	14% to 15%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16%
$25 to $50 list	24% to 25%

DISCOUNT—CHICAGO

Less than $10 list	+5% to 5%
$10 to $25 list	10% to 16%
$25 to $50 list	14% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to net
1/5 to std. pkg.	Net to 15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List, Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	List Net	List Net to + 10%
$2.00 to $10.00 list	10% to 20%	5% to 10%
$10.00 to $50.00 list	20% to 30%	15% to 20%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25% to 50%	20% to 40%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$5.00 to $7.50
Discount	25% to 30%

CHICAGO

List price	$5.00 to $6.00
Discount	30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

No. 18, less than full spools	$0.44¼ to $0.65
No. 18, full spools	0.43¾ to 0.55

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.64 to $0.65
No. 18, full spools	0.54 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
11.	$15.00-$18.00	$13.00-$14.00	$11.25-$12.00
12.	23.25- 27.09	21.30- 23.22	19.35- 20.85
10.	32.40- 37.80	29.70- 32.40	27.00- 29.25
8.	45.70- 53.34	41.90- 45.73	38.00- 41.38
6.	72.40- 84.42	66.35- 72.40	60.30- 65.50

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$18.00	$13.50	$12.00
12	25.21-27.37	21.30-27.39	17.40-23.46
10	35.29-38.15	29.82-32.70	24.35-39.97
8	49.91-53.83	42.18-46.14	34.45-42.29
6	78.95-85.19	60.85-61.16	51.15-54.76

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$35.25 to $40.00
25 to 50 lb.	39.00
50 to 100 lb.	34.25 to 38.00

CHICAGO

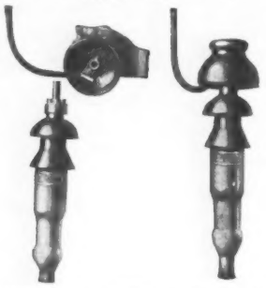
	Per 100 Lb. Net
Less than 25 lb.	$40.35
25 to 50 lb.	39.35
50 to 100 lb.	38.35

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Outdoor Cable Terminal

An outdoor type D. O. A. cable terminal known as the protected disconnection style has recently been placed on the market by the Standard Underground Cable Company of Pittsburgh, Pa. All the copper parts are covered



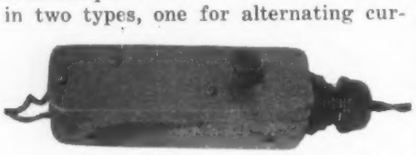
DISCONNECTING TYPE OF CABLE TERMINAL

by a porcelain hood, as shown in the accompanying illustration, which permits the disconnection of the aerial extension wire even while the circuit is alive.

All the outdoor (type D. O. A.) cable terminals made by this company are readily disconnected from the aerial conductor by means of either a set-screw, a cap-nut or a turnbuckle stem. The stem of the new terminal is a modification of the regular cap-nut stem and has some additional advantages where frequent disconnection of the aerial circuit from the terminal is necessary.

Automatic Controller

The Automatic Electric Controller Company of Seattle, Wash., is manufacturing an automatic controller that regulates the amount of current delivered to any heating appliance and maintains the heat of the appliance at an even temperature. This device is made in two types, one for alternating cur-

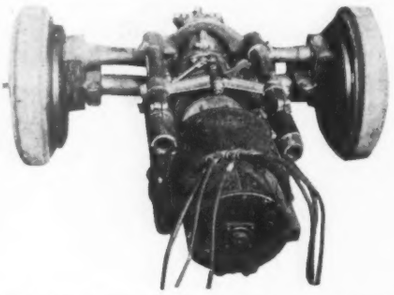


FOR USE WITH HEATING APPLIANCES

rent and the other for alternating and direct current. The controller consists of a thermostat, composed of copper and iron riveted together, which is placed immediately over a heating coil and connected in series with the load. The heat from the coil causes the thermostat to break the circuit whenever the temperature rises above a certain point. The handle on the outside of the case can be set at any point as lettered from *A* to *K*. *A* corresponds with zero degrees, *B* with 90, and *C* with 160. The turning of the handle causes the contact point which touches the thermostat to move downward and bend the thermostat. Thus the more the thermostat is bent the more heat is necessary and the higher the temperature required to cause it to bend still further and break the circuit. By the use of this device it is claimed that 40 per cent of the energy now used in the excess heating of irons, percolators, toasters, chafing dishes, etc., can be saved, as the exact amount of heat required can be obtained and the excess eliminated.

Industrial Truck

In the design of the industrial truck made by the Karry-Lode Industrial Company, Inc., Long Island City, N. Y., the makers point out that particular attention has been given to strength,



DRIVING UNIT THAT CAN EASILY BE REMOVED FOR REPAIRS

flexibility, simplicity, accessibility and reliability. A 3½-hp. motor especially designed for this truck, of ample overload capacity, is a unit with the entire electrical system, giving maximum efficiency under all conditions, it is said. The frame is of 4-in (10-cm.) channel beam, securely held by cross-members of ample section, reinforced by corner plates. Every cell in the battery box is instantly accessible. The batteries are placed below the loading platform out of sight, with available room to permit of additional batteries. The rear axle is of the internal-gear type, making it possible to carry the load on a 2¾-in. (5.99-cm.) axle of seamless tubing. The driving shaft is of solid nickel steel. The wheels run on large-size Hyatt roller bearings. The controller has three speeds forward and three reverse.

A special feature of this truck is that the rear wheels and motor can be taken out in case repairs must be made on them and others installed in short time. This insures almost continuous service.

Ground Clamps

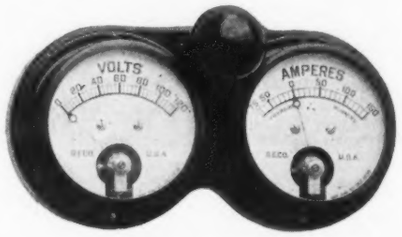
Ground clamps adjustable for rigid and flexible electric light and power conduits are made by the Utility Fittings Company of Philadelphia. The makers point out that the principal feature of these clamps is the easy way in which they may be connected to the ground pipe and ground wire. These clamps are made of soft copper, tinned all over, fitted with 1¼-in. (3.2-cm.) bolt and nut, and have been approved by the Underwriters' Laboratory.

Combination Volt-Ammeter

The General Electric Company of Schenectady, N. Y., has developed a direct-current duplex instrument with self-contained attachment for illuminating the dials. This volt-ammeter is particularly adapted to electric vehicles and small direct-current panel applications such as are used for battery-charging sets and lighting.

It consists of an ammeter and a voltmeter mounted on a bakelite base with outside dimensions of 5½ in. by 2⅞ in. and 1⅜ in. deep (14 cm. by 7.3 cm. by 3.5 cm.).

The D'Arsonval permanent-magnet moving-coil construction is used in both elements. The resistance for the voltmeter is self-contained; the ammeter requires an external shunt. The instruments are finished in dull black and can be equipped with paper scale with black marking or with metal scale plate and white figures on black background. Voltmeter standard capacities range from 10 volts to 150 volts, and for the ammeter any desired capacity can be obtained, either for one way indication or double, showing charge and discharge readings.



COMBINED METER SIMPLIFIES INSTRUMENT INSTALLATION

For electric vehicles cable leads are furnished for connection to terminals set in back of the instrument in order that all wiring can be concealed. For panel work stud terminals can be supplied, which serve as terminals and holding lugs.

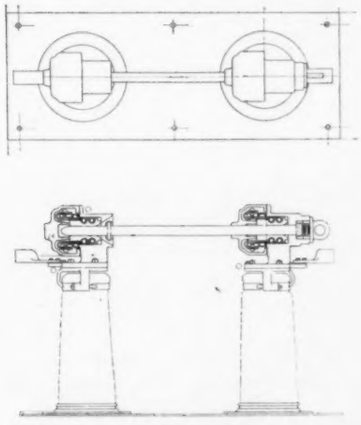
Bell-Ringing Transformer

One of the bell-ringing transformers now being manufactured by the A. E. Rittenhouse Company, Honeoye Falls, New York, is inclosed in a non-breakable pressed-steel case. An ordinary battery bell can be operated with this transformer, it is stated, once it is properly adjusted for alternating current. Where groups of bells are to be operated two transformers may be used with a secondary winding connected in series where higher voltage is desired. If higher amperage is needed, the secondary coils of the two instruments may be connected in parallel. The coils are independently wound and are designed to withstand a 2500-volt insulation test between primary and secondary coils and also between the coils and the case. Continuous short-circuit of the secondary, it is pointed out, will not burn out the instrument.

Disconnecting Switch for Restricted Quarters

The ordinary high-voltage knife-blade disconnecting switch is operated by a hook on the end of a long rod. This necessitates an amount of space for the operator directly below the switch and perpendicular to its base which depends both upon the length of the blade and of the rod used to open and close the switch. In some plants the space on which the operator would have to stand to use the switch hook at the considerable angle required is so small in relation to the height of the disconnecting switch that the usual design is practically prohibitive.

The switch shown herewith is operated from directly below by a disconnecting switch hook. The insulators, insulator caps and terminals are standard. The blade is a copper rod with a cast eye fastened on one end and a readily renewable solid brass contact



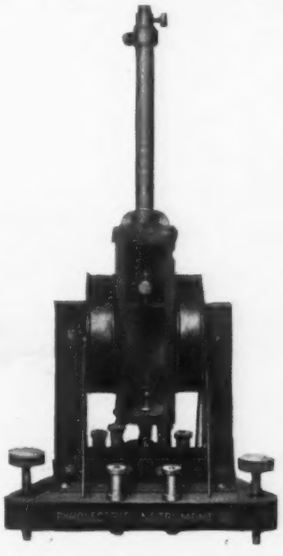
HIGH-VOLTAGE DOWNWARD-OPENING DISCONNECTING SWITCH

tip on the other. When the switch is opened a flange near the tip of the blade prevents the blade from dropping below the upper part of the lower stationary contact. A wide flare on the lower end of the upper contact leads the blade into place when the switch is being closed. After the blade is closed a slight turn to the right or left by the operating rod locks the blade in position and prevents it from opening except when desired.

This switch is made by the General Electric Company of Schenectady, N. Y.

Alternating-Current Galvanometer

The Pyrolectric Instrument Company of Trenton, N. J., announces its Northrup alternating-current galvanometer. The maker points out that it is especially adapted to the following uses: (1) For the accurate measurement of the resistivity or conductivity of salt solutions and other electrolytes; (2) for the measurements of the resistivity of molten salt; (3) for the measurement of the resistivities of molten metals; (4) for the measurement of any resistance in which small irregular emfs. exist; (5) for the comparison of small inductances using the bridge method; (6) for the comparison of capacities using the bridge method.



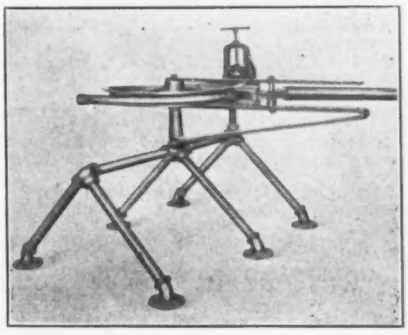
MOVING COIL IS LONG AND NARROW

The galvanometer is mounted on a base of ebonite provided with leveling screws. The field magnets are laminated. Magnetizing coils are wound on non-metallic spools, which are placed on the field poles as close as possible to the moving coil. Pole pieces are given a hollow cylindrical form about the moving coil, this special shape preventing the coil, when on closed circuit, from assuming a position of unstable equilibrium due to currents induced in its circuits by the alternating magnetic field. The moving coil is long and narrow, so that its moment of inertia is small, thereby permitting high sensitivity with a quick period. The entire hanging system is exposed to view through a glass front. The central housing is of non-conducting material to prevent the formation of eddy currents.

The sensitivity is adjustable through a wide range, the strength of magnetism being variable by varying the current through the field coils.

Pipe Bender

A pipe bender that bends pipes cold without treating or filling of any kind is made by the American Pipe Bending Machine Company of Boston, Mass. It is claimed that this device does not weaken the metal or open seams. This



CAN BE HANDLED BY UNSKILLED WORKMEN

bender, which can be operated by unskilled workmen, will bend a 2-in. (5.08-cm.) pipe to a 90-deg. angle in about one minute. The entire weight with 2-in. head (5.08-cm.) is about 400 lb. (181.4 kg.) and with full complement of seven heads from ⅜-in. to 2-in. (0.9-cm. to 5.08-cm.), the total weight is about 550 lb. (226.8 kg.).

Combination Tool Outfit

A combined drill press, vise, emery wheel and anvil for use in places where space is at a premium has been developed by the Chicago Flexible Shaft Company. The outfit is also equipped with a pipe vise and metal cutter. The entire machine weighs but 90 lb. (40.8 kg.). The jaws of the vise are 4 in. (10.2 cm.) wide and are faced with steel. A 4½-in. (11.4-cm.) opening is provided and the jaws are controlled by a hand wheel which operates as a tool feed when the machine is being used as a drill press. Square shank drills and reams are used by putting them into the upper spindle of the gear train, thus providing three speeds for operating the tools.

Miniature Lamp Decorative Outfit

The Triangle Electro Trading Company of 79 Chambers Street, New York City, is manufacturing an auxiliary outfit of electrically illuminated figures and flowers for use with its eight-light current outfit. Five of the fanciful 3½-volt bulbs are designed for connection in series and take the place of a single 14-volt lamp. The bulbs for use with the miniature outfit may be selected from a various assortment of roses, animals, faces, etc. The equipment is useful for table decorations and for showcase and store-window display.

Trade Publications

MOTOR-GENERATOR SETS. — Julius Andrae & Sons Company, Milwaukee, Wis., has prepared a booklet descriptive of its motor-generator sets.

PIPE BENDER.—A folder descriptive of a pipe bender has been issued by the American Pipe Bending Machine Company of Boston, Mass.

WATER PURIFIER.—The American Utilities Company of St. Joseph, Mich., has prepared a leaflet descriptive of its Barnes electric water purifier.

DISTRIBUTION SYSTEMS.—L. K. Comstock & Company of New York have prepared bulletin No. 5, entitled "The Electrical Distributing System and Who Shall Install It."

BELL-RINGING TRANSFORMERS.—Bulletin No. 11, descriptive of bell-ringing transformers, is being distributed by the A. E. Rittenhouse Company of Honeoye Falls, N. Y.

ADJUSTABLE SPEED MOTORS.—The General Electric Company of Schenectady, N. Y., has prepared bulletin No. 41,021, descriptive of its RF adjustable-speed motors.

GROUND CLAMPS.—The Utility Fittings Company, 812 Walnut Street, Philadelphia, is distributing a resale sheet dated Oct. 1, 1917, descriptive of its approved ground clamps.

OIL PUMPS.—Snow oil pumps are illustrated and described in bulletin No. S-112, prepared by the Worthington Pump & Machinery Corporation, 115 Broadway, New York City.

PANELBOARD CABINETS. — General catalog No. S-2, descriptive of Benjamin-Starrett panelboard cabinets, has been issued by the Benjamin Electric Manufacturing Company of Chicago.

INDUSTRIAL TRUCKS. — Karry-Lode industrial trucks and tractors are described in an attractive folder now being distributed by the Karry-Loae Industrial Truck Company, Inc., Long Island City, N. Y.

MOTOR STARTER.—The Machine Products Company of St. Louis, Mo., is distributing a folder descriptive of the Johns type rotary starter for the automatic acceleration of single-phase, polyphase and direct-current motors.

ELECTRIC OVENS.—The Hughes Electric Heating Company, 5660 West Taylor Street, Chicago, has prepared a bulletin descriptive of its electric ovens for bread, cake and pastry baking, boiling, roasting and industrial baking purposes.

DISCONNECTING HANGERS.—Thompson safety disconnecting hangers for use indoors and outdoors are illustrated and described in supplement C to catalog B-16, prepared by the Thompson Electric Company, 5606 Euclid Avenue, Cleveland.

FOREIGN TRADE. — The Bureau of Foreign and Domestic Commerce of the Department of Commerce at Washington has issued bulletin No. 24, "Foreign Trade Notes," which is a reprint from "Commerce Reports" for January-March, 1917. Price, 15 cents.

TOOL OUTFIT.—The Stewart handy worker, a device which comprises drill press, a vise, pipe vise, anvil, metal cutter and a substantial three-speed machine, is illustrated and described in a folder distributed by the Chicago Flexible Shaft Company of Chicago.

ELECTRIC FURNACES. — Up-to-date facts on electric furnaces for the melting and refining of ferrous and non-ferrous metals is the subject of bulletin No. 40, now being distributed by the Industrial Electric Furnace Company, 53 West Jackson Boulevard, Chicago.

ELECTRIC WARE.—Catalog 8-C, dated September, 1917, is being distributed by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. This bulletin describes Westinghouse electric heating and cooking appliances for use on alternating-current and direct-current circuits.

BRONZE.—The Titanium Bronze Company, Inc., Niagara Falls, N. Y., has issued a twelve-page booklet pointing out the advantages of titanium aluminum bronze for use in gears, pump valves and for other castings requiring strength, good-wearing qualities and high resistance to shock.

SAFETY PANELS AND CABINETS.—Bulletin No. 1D, descriptive of safety panels and cabinets, has been prepared by the Crouse-Hinds Company of Syracuse, N. Y. Two types of panelboards are listed in this bulletin—type DPS, arranged for Edison plug fuses in branches, and type EPS panels, arranged for N. E. C. cartridge fuses in the branches.

BALL BEARINGS.—"Wood-Work Precision at High Speed" is the title of a bulletin now being distributed by the S K F Ball Bearing Company of Hartford, Conn. A short article in this bulletin tells why S K F ball bearings are used on wood-working machinery, and a description and history of the S K F ball bearing is added. Only those wood-working machines that are in general use are dealt with, and from this the prospective user can form an idea of the wide range of uses for S K F self-aligning ball bearings.

Trade Notes

GUY R. HASTINGS is now manager of Chicago sales for the National X-Ray Reflector Company, Chicago.

THE LACLEDE - CHRISTY CLAY PRODUCTS COMPANY, St. Louis, Mo., has removed its general office downtown to the Railway Exchange Building.

NORMAN B. HICKOX is the new sales manager of the National X-Ray Reflector Company, Chicago, to succeed Ernest H. Cameron, who has resigned and is now at Seattle, Wash.

THE WARD LEONARD ELECTRIC COMPANY of Mount Vernon, N. Y., is now represented in Cleveland, Ohio, by the Walter P. Ambos Company, in the Arcade, and in Pittsburgh, Pa., by Sperry & Bittner, in the First National Bank Building.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., is having plans prepared for the construction of a new two-story drop-forge factory, about 85 ft. by 100 ft. The company will also build a new one-story and basement substation, 48 ft. by 100 ft.

FORD, BACON & DAVIS, New York City, announce that they are prepared to devote special attention to the appraisal of industrial property for the purpose of war-tax returns, as called for by the war-profits tax section of the revenue law recently enacted by Congress.

THE NUGENT ELECTRICAL SUPPLY COMPANY, New York City, announces that it is established at 7 West Twenty-ninth Street as jobber in electrical supplies. Frank L. Nugent and Walter Williamson of the company have had many years' experience in this line.

A. H. COX & COMPANY, Seattle, Wash., are moving into larger quarters, taking the building which adjoins their present one, 309 First Avenue South, giving a frontage of approximately 60 ft., with a total floor space of seven floors. The engineering departments have likewise been expanded.

THE AUGUST MIETZ CORPORATION, 128 Mott Street, New York City, has recently increased its factory space for the purpose of taking care of the enlarged demand for its oil engines. The company states that it is now in a better position, on account of its increased facilities, to accept orders for larger machines.

HUGH D. BUTLER has been appointed assistant sales manager of the National X-Ray Reflector Company, Chicago, and will devote special attention to large companies whose range is national in scope and to campaign work on special classes of business. Mr. Butler, in addition to this, will direct the architectural and maintenance feature of the company's work.

WALTER S. CRANMER, who for many years was connected with the sales department of the Waverley Company of Indianapolis, Ind., and later with the Woods Motor Vehicle Company of Chicago, has recently been appointed assistant manager of sales of the Philadelphia Storage Battery Company, with headquarters at Philadelphia. Mr. Cranmer for the past few years has been in charge of the sales of this company in Pennsylvania, Delaware and New Jersey.

THE DOMESTIC ENGINEERING COMPANY, Dayton, Ohio, on account of the resignation of President Deeds, to accept a colonel's commission in the regular army, has been undergoing a reorganization of staff. C. S. Kittering was elected president to succeed Colonel Deeds; Alfred P. Sloan, Jr., vice-president; G. B. McCann, treasurer; F. J. Blose, secretary. These officers, with Mr. Kittering as chairman, constitute the Board of Directors with the following: W. A. Chryst, O. L. Harrison, J. B. Hayward, O. Kressler, L. Ruthenburg, W. E. Cromer, F. B. MacNab, Judge B. F. McCann and Ernest Boehme.

New Incorporations

THE BROOKSIDE ELECTRIC COMPANY of Cleveland, Ohio, has been chartered with a capital stock of $5,000 by Paul Jung and others.

THE NATIONAL ELECTRIC & CONSTRUCTION COMPANY of Mansfield, Ohio, has been chartered with a capital stock of $10,000 by Frank Mattox and others.

THE TWIN CITIES ELECTRIC & SUPPLY COMPANY of Measha, Wis., has been chartered with a capital stock of $5,000 by Joseph Hill, Victor M. Gombert and F. W. Gombert.

THE NATIONAL ELECTRIC ADVERTISING COMPANY of Chicago, Ill., has been incorporated with a capital stock of $2,500 by J. D. Smith, Robert W. Dunn and W. P. Dunn.

THE OPATITE GLASS & ELECTRIC COMPANY of Chicago, Ill., has been incorporated with a capital stock of $1,000 by L. H. Ekstromer, H. G. Phelps and F. William Rehbock.

THE WORLD ELECTRIC MACHINERY COMPANY of Boston, Mass., has been incorporated with a capital stock of $25,000. Max Freedman is president and Charles M. Waugh of Cambridge is treasurer.

THE ELECTRIC CONSTRUCTION COMPANY of Racine, Wis., has been incorporated with a capital stock of $18,000. The incorporators are Charles F. Breitzke, William B. Pierce and others.

THE HENRY J. RUEFF COMPANY of Louisville, Ky., has been chartered by Henry J. Rueff, N. C. Hall and L. A. Hickman. The company is capitalized at $10,000 and proposes to deal in lighting fixtures and electrical specialties.

THE ELECTRICAL METALS & MANUFACTURING COMPANY of Youngstown, Ohio, has been incorporated with a capital stock of $150,000 by Frank P. Pyle, Paul H. Stambaugh, William M. Henderson, H. H. Wickham and William Schneider.

THE SANDBACK-GILBERT ELECTRIC COMPANY of New York, N. Y., has been incorporated with a capital stock of $500 to do a general electrical business. The incorporators are: Samuel Solinsky, William A. Sandback and Charles Gilbert.

THE NORTH MAHONING TOWNSHIP LIGHT, HEAT & POWER COMPANY of Clearfield, Pa., has been incorporated with a capital stock of $5,000 by W. O. Hoover and associates. The company proposes to operate a power plant in Clearfield County.

THE WEYANT ELECTRICAL COMPANY of New York, N. Y., has been incorporated by William L. Clark, Clyde C. Wallace and William G. Miller, Jr. The company is capitalized at $5,000 and proposes to do a general electrical engineering business.

THE STANDARD SELF - STARTER COMPANY of New York, N. Y., has been chartered with a capital stock of $10,000 to manufacture automobile self-starting devices. The incorporators are: B. L. Darrow, J. L. Brulatour and J. J. Blemly, 441 West Thirty-fourth Streeet, New York.

THE PHYLLIS ELECTRICAL CORPORATION has been chartered by Philip M Brill of Caldwell, N. J.; N. E. Evans of White Plains, N. Y., and Leo Weil, 878 Kelly Street, the Bronx, New York, N. Y. The company is capitalized at $2,500 and proposes to do a general electrical contracting business.

THE STANDARD ELECTRIC COMPANY of Indianapolis, Ind., has been incorporated with a capital stock of $500,000. The company will build a plant at Noblesville, Ind. The directors are: E. C. Applegate, president and treasurer; D. H. Duncan, vice-president and factory manager, and Henry Bartlett.

THE YORK ELECTRIC COMPANY of Toronto, Ont., has been incorporated by Dyce W. Saunders, 71 Bay Street; Stanley S. Mills, Paul Home and others. The company is capitalized at $40,000 and proposes to do a general electrical engineering business and to manufacture electrical and mechanical machinery, equipment, etc.

THE AUTOMATIC ELECTRIC DEVICES COMPANY and the Simplex Controller Company of Cincinnati, Ohio, have been incorporated with a capital stock of $10,000 and $5,000 respectively, by Clarence E. Ogden and others. The companies will equip and operate a joint plant to manufacture electric specialties. The offices of the companies are located at 515 Mercantile Library Building, Cincinnati.

New England States

HOULTON, ME. — The Smyrna Mills Electric Light & Power Company, recently organized at Houlton, proposes to supply electricity for lamps and motors in the towns of Smyrna, Oakfield, Merrill and Dyer Brook. The company is capitalized at $10,000. Peter J. Garcelon of Houlton is president, and Arthur A. Garcelon of Merrill is treasurer.

NORWAY, ME.—The 250-kw. generator in the plant of the Oxford Electric Light & Power Company was wrecked by an explosion recently. Arrangements will be made to secure power temporarily from the power station at South Paris.

RUTLAND, VT.—The Rutland Railway, Light & Power Company has made arrangements with the Staso Milling Company of Fair Haven and Poultney to change its electric service (1400 hp.) in 25-cycle motors to 60-cycle motors. To make this change a transmission line will be erected from Castleton Corners to Hampton, N. Y. The Rutland Company has closed a contract with the F. R. Patch Manufacturing Company for a 335-hp. motor.

ATTLEBORO, MASS.—Plans are being made by the Attleboro Steam & Electric Company to make connection with the electric transmission lines of the Narragansett Electric Lighting Company of Providence to obtain electricity for an emergency supply. The Narragansett company's lines already extends into Seekonk.

MILBURY, MASS.—The Selectmen have granted the petition of the Worcester Suburban Electric Company asking for pole locations in West Milbury. The company is extending its service to that portion of the town.

WESTFIELD, MASS.—The Board of Selectmen has granted the petition of the Turners Falls (Mass.) Power & Electric Company for a franchise to enter the town and supply energy to the Springfield Street Railway Company, through a power station on the Westfield River dike.

ESSEX, CONN.—At the annual town meeting held recently the citizens voted to enter into a contract with the Essex Light & Power Company for lighting the streets with electricity for a period of five years, at $4,200. The old acetylene gas-lighting plant was dismantled two years ago and since then the streets have been in darkness.

MONTVILLE, CONN.—At a special town meeting held recently it was voted to enter into a contract with the Connecticut Power Company of New London for street lighting. The contract calls for about 75 lamps.

UNCASVILLE, CONN.—Negotiations are under way between the Selectmen and the Connecticut Power Company of New London for lighting some of the principal streets in the villages of Uncasville and Palmertown.

Middle Atlantic States

BINGHAMTON, N. Y.—Preparations are being made by the Hires Condensed Milk Company, 913 Arch Street, Philadelphia, Pa., for the construction of a new plant for the manufacture of tin cans. The plans provide for the erection of a large power plant. Contract for the construction of the proposed plant has been awarded to John L. Lewis, 36 Wall Street, Binghamton. The cost of the entire project is estimated at $500,000.

BROOKLYN, N. Y.—The contract for construction of a new three-story, reinforced concrete power house at the naval hospital at the Brooklyn navy yard has been awarded to the Whitney Company, 101 Park Avenue, New York, N. Y. The building will be 58 ft. by 107 ft., and will cost about $100,000.

BUFFALO, N. Y.—The Kelly Island Lime & Transport Company, 110 Hamburg Turnpike, is planning to erect a new transformer station at its works.

NEW YORK, N. Y.—Plans have been prepared for the erection of an addition to the boiler house at the plant of John Huber, at Sixth Avenue and Sixty-second Street, to cost about $4,000. Brustus Gundlach, 212 Fifth Avenue, is architect.

OGDENSBURG, N. Y.—The St. Lawrence Transmission Company, it is reported, contemplates the erection of a new steel tower electric transmission line from Ogdensburg to Hannawa Falls.

OLEAN, N. Y.—Extensive improvements are contemplated by the Pennsylvania Railroad Company at its local works, including an addition to power house, to cost about $20,000. Contract for construction of power house has been awarded to the Tifft Construction Company, Buffalo, N. Y.

ROCHESTER, N. Y.—Plans are being prepared for extensions and improvements to the power house of the North East Electric Company, 348 Whitney Street. Joseph Oberlies, Granite Building, Rochester, is architect.

ROCHESTER, N. Y.—The construction of a new power house at Irondequoit, 40 ft. by 80 ft., is under consideration by the Department of Public Works. Plans for the building are being prepared by C. M. Hirschfeider, 62 State Street, Rochester.

SYRACUSE, N. Y.—The Auburn & Syracuse Electric Railway Company has applied to the Public Service Commission for permission to issue $292,000 in bonds, the proceeds to be used to take up existing obligations, extensions, etc.

BELLEVILLE, N. J.—The Public Service Electric Company has submitted a bid to the Board of Commissioners for lighting Washington Avenue with electric lamps for a period of five years.

HADDONFIELD, N. J.—The Town Commissioners are considering the installation of a new electric-lighting system in various streets in the town, for which plans are being prepared by the Wrightstown Utilities Corporation, which recently acquired the Wrightstown Water Company.

NEWARK, N. J.—Plans are being prepared by the Neuman Hardware Company, 9-17 St. Francis Street, for the construction of a new boiler house, 45 ft. by 60 ft., to cost about $8,500.

NEWARK, N. J.—Plans have been filed by the Board of Education for the construction of an addition to the boiler plant at the Alexander Street Public School, to cost about $15,500. Contract has been awarded to the Frederick Fatzler Company, 810 Broad Street, for erection of building.

POMPTON LAKES, N. J.—Arrangements have been completed by the Council for the lease of the Edwin Corning property for the construction of an addition to the municipal electric-light plant. The lease is for a period of 21 years, embodying a provision that the property may be purchased by the borough within ten years. Power in the new addition will be generated by hydraulic engines.

WEST ORANGE, N. J.—Plans, it is reported, have been prepared for the construction of a new power house, about 100 ft. by 100 ft., at the Thomas A. Edison Works on Lakeside Avenue. M. Arthur Wolff is engineer.

BIRDSBORO, PA.—Preparations are being made by the Reading Railway Company for the installation of new elertrically driven pumping machinery in its water works system just south of the city.

CATAWISSA, PA.—The Borough Council has decided to abandon the municipal electric-light plant and enter into a contract with the Columbia & Montour Electric Company of Bloomsburg for electrical service. A 24-hour service, it is expected, will soon be established.

PHILADELPHIA, PA. — The Bellevue Worsted Mills, Wister Street, is contemplating the construction of a new power house, 30 ft. by 40 ft., at its works at Sixteenth and Hunting Park Avenues.

SAYRE, PA.—The Sayre Electric Company, which recently secured a contract to furnish electrical service to the Hart Planing Mills, has completed connections to this plant. The company has also been awarded a renewal of its electric street-lighting contract with the borough of Athens.

TUNKHANNOCK, PA.—The power plant of the Tunkhannock Electric Company was destroyed by fire on Oct. 21, causing a loss of about $12,000.

LYNCHBURG, VA.—W. K. Barger of Lynchburg, general contractor to erect the Young Men's Christian Association Building in Lynchburg, has awarded the contract for electric wiring to Clifton W. Whitmore of Lynchburg. The cost of the building is estimated at about $100,000.

NORFOLK, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 19, for furnishing and installing one electric freight elevator in building 16, at the navy yard, Norfolk (Portsmouth), Va. Drawings and specifications (No. 2638) may be obtained upon application to the above bureau or to the commandant of the navy yard named.

ROANOKE, VA. — Arrangements have been made for the installation of an ornamental lighting system on Salem Avenue, from Jefferson Street to Commerce Street, to cost about $3,000. The work will be done by the Roanoke Railway & Electric Company at the expense of the property owners. The city will take over the new system about the first of January and provision will then be made for its maintenance and possibly for its extension toward Market Square.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

North Central States

TRAVERSE CITY, MICH.—The upper power plant of the Boardman River Electric Light & Power Company was destroyed by fire on Oct. 20, causing a loss of about $50,000.

AKRON, OHIO.—Contract, it is reported, will soon be awarded by the Northern Ohio Traction & Light Company for the construction of a train shed and underground subway on North Main Street. F. C. Warner, Hippodrome Annex, Cleveland, is architect.

CLEVELAND, OHIO. — A permit has been granted to the General Electric Company for the erection of a power house at 2242 Flournoy Street, to cost about $10,000. F. D. Chase is architect.

CLEVELAND, OHIO.—Extension of the ornamental-lighting system in the downtown section to illuminate considerable adjacent territory is under consideration. Extension of the system, which is based on the substitution of high-power incandescent lamps for arc lamps, will extend as far as East Fifty-fifth Street on the East Side and as far as West Fifty-eighth Street west of the river. When the work is completed 1060 ornamental lamps will be in operation instead of 620.

URBANA, OHIO.—Bids will be received by the County Commissioners until Nov. 12 for wiring the court house, sheriff's residence and jail for electric lighting in accordance with plans prepared by C. C. & E. A. Weber of Cincinnati, architects.

ALEXANDRIA, KY.—The grand jury in its report to Circuit Judge Wolff at Alexandria has recommended the installation of a better lighting system at the County Infirmary.

CHICAGO, ILL.—The Gas & Electric Motor Bus Corporation of Chicago has leased a one-story machine shop at Racine and Belden Avenues, which will be used as a repair plant and factory for making spare parts.

MILLSTADT, ILL.—Plans are being prepared by the Fuller-Coult Engineering Company, Chemical Building, St. Louis, Mo., for improvements to the municipal electric-light plant, including the installation of boilers, engine, generator, switchboard and pumps.

MARATHON, WIS.—The Wisconsin Valley Electric Company of Wausau has applied for a franchise to erect electric transmission lines in Marathon to supply electricity for lamps, heaters and motors.

TOMAHAWK, WIS. — The Council has engaged R. W. Richardson of St. Paul, consulting engineer, to prepare plans for improvements to the municipal water-works system, which will include a new pumping station, 20 ft. by 25 ft. and an electrically driven centrifugal pump with a capacity of 300 gal. per minute. The cost is estimated at $20,000.

WATERTOWN, WIS.—The Washington Cutlery Company, which is erecting an addition to its factory, at a cost of about $15,000, is contemplating the installation of a new heating and power plant, to cost about $10,000.

ELY, MINN.—An election has been called for Nov. 6 to vote on the proposal to issue $180,000 in bonds for municipal improvements, among which is the installation of a new septic system at the municipal power plant, at a cost of $18,000. The New York Continental Jewell Filtration Company has the contract for the work.

BOYDEN, IOWA.—Steps have been taken by the farmers north of Boyden to organize a company to erect and operate an electric distribution system to supply electricity in that district. The cost of the lines is estimated at $5,000, of which $3,000 is already guaranteed. Work will start at once on the construction of the line, which will cover about 11½ miles. Energy to operate the system will be furnished by the Veen Schoten Electric Light Company of Boyden.

BURLINGTON, IOWA.—A movement is under way to extend the ornamental lighting system from Jefferson Street up Third to Columbia Street, a distance of two blocks; also from Jefferson Street to the new bridge on Main Street, a distance of four blocks.

FORT MADISON, IOWA.—Preparations, it is reported, are being made by the Atchison, Topeka & Santa Fe Railroad

Company to build a large power plant at its shops and yards in Shopton.

BETHANY, MO.—Bonds to the amount of $4,500 have been voted, the proceeds to be used for the installation of an oil engine in the municipal electric-light plant.

FREDERICKTOWN, MO.—At an election held recently the proposal to sell the municipal electric-light plant to the Missouri Public Utilities Company of Cape Girardeau was defeated. An expenditure of a considerable amount of money will be required to put the plant in shape to meet the demands for electrical service, which will be considered by the Council.

KANSAS CITY, MO.—The Kansas City Light & Power Company is reported to have purchased a site (25 acres) on the Missouri River in the northeast section of the city, 1½ miles down the river from the foot of Grand Street, on which it proposes to erect an electric generating station for an ultimate capacity of 250,000 kw. The plans for the initial installation provide for 40,000 kw. The first section of the building will be 225 ft. by 200 ft., for which contract for foundations has been awarded to the Foundation Company, 233 Broadway, New York, N. Y. Contracts for equipment have been awarded as follows: Two 20,000-kw. turbines, to the General Electric Company; two condensing outfits, to the Worthington Pump & Machinery Corporation of New York, N. Y.; six boilers, to the Babcock & Wilcox Company of New York; six underfeed stokers, 16 retorts each, to the Sanford Riley Stoker Company of Worcester, Mass.; fuel economizers with induced-draft fans to the Green Fuel Economizer Company of Matteawan, N. Y., Sargent & Luddy, 72 West Adams Street, Chicago, Ill., are engineers.

ST. LOUIS, MO.—The contract for the electric work in connection with the erection of convent for the Sisters of Mercy, to cost about $250,000, has been awarded to the Eclipse Electric Company of St. Louis.

VERSAILLES, MO. — The city of Versailles will rebuild its municipal electric-light plant, recently destroyed by fire.

WILLOW CITY, N. D.—A franchise has been granted to the Minot (N. D.) Electric Company to install and operate an electric-light plant in Willow City, the plant to be ready for operation by Jan. 1.

HIGHMORE, S. D.—At an election held recently the proposal to issue bonds for the purchase of an electric-lighting plant was carried.

SHELTON, NEB.—The town of Shelton has entered into a contract with the Central Power Company of Grand Island for the installation of an ornamental lighting system on Main Street in the business section of the city.

WAYNE, NEB.—Contracts have been placed by the City Council for a new engine and other necessary apparatus to establish a second lighting unit to furnish service to the State Normal School and other consumers using alternating current.

BARNES, KAN.—Bonds to the amount of $10,000 have been voted for the installation of an electric-lighting system in Barnes. The plans provide for the erection of an electric transmission line to Concordia.

CUBA, KAN.—At a special election to be held Nov. 6 the proposal to issue $10 000 in bonds for the installation of an electric-lighting system in Cuba will be submitted to the voters. The proposed plans provide for the erection of an electric transmission line into the city by the Concordia Electric Light & Power Company.

Southern States

ASHEVILLE, N. C.—Contracts have been awarded by the Kenilworth Hotel Company to the Carolina Wood Products Company of Asheville and the Krahl Construction Company of Chicago to erect a hotel at Kenilworth, Biltmore, to cost about $500,000. The plans provide for the installation of a Warren-Webster heating system, to cost $35,000; electric-lighting, $35,000, and two Otis elevators, $6,500. Orders have been placed for everything but electric wiring, lighting fixtures and furniture. For further information address Roscoe A. Marne, Kenilworth, Biltmore.

ANDERSON, S. C.—The North Anderson Promotion Company, recently organized, has purchased the electric-lighting system in North Anderson. Lee G. Holleman, A. S. Farmer and John W. Linley are interested in the company.

HOLLY HILL, S. C.—Steps have been taken by local citizens to organize a company to construct and operate an electric-lighting plant in Holly Hill. The installation of an ice plant is also included in the project. The company will be incorporated under the name of the Holly Hill Electric Service Company. H. W. Pearce is president and R. G. Carson treasurer.

CALLAHAN, FLA.—The installation of an electric-lighting plant is under consideration by the City Council.

JACKSONVILLE, FLA.—Plans are being considered by the City Commission for the erection of a new 6000-volt cable from the municipal substation to the plant of the Hillyer-Sperring-Dunn Company on the South Side. The commission is also considering extension of the electric lighting system to South Jacksonville. New machinery will be installed to increase the output of the plant to 12,000 kw. to supply electricity to the cantonment near the city. The cost of the machinery is estimated at $65,000.

JACKSON, TENN.—The City Council has awarded the contract for the installation of an ornamental lighting system on 38 blocks. Four iron standards will be erected on each block.

PASCAGOULA, MISS.—The International Shipbuilding Company contemplates the construction of an electric-light plant to supply electricity for its shipyards and for lighting the residences of employees.

JONESVILLE, LA.—Arrangements are being made for the construction of a municipal electric-light plant in Jonesville. Machinery, it is understood, has been purchased.

HAILEYVILLE, OKLA. — The Choctaw Power & Light Company of McAlester has applied for a franchise to supply electricity in Haileyville.

MIAMI, OKLA.—Bonds to the amount of $45,000 have been issued for improvements to the municipal electric-lighting plant.

STILLWATER, OKLA. — The contract for electric wiring for the new court house at Stillwater has been awarded to McEldowney & Son Electric Company of Oklahoma City. The cost of the building is estimated at $110,550. The Lisle-Dunning Construction Company of Oklahoma City is general contractor.

BOWIE, TEX.—At an election held recently the proposal to issue $15,000 in bonds, the proceeds to be used for the construction of an electric-light and power plant, was carried.

DALLAS, TEX. — Contracts have been awarded by the Fred A. Jones Construction Company of Dallas, general contractor, for the building of the Southland Life Insurance Company, as follows: For electrical work to the Cammack Electric Company of Dallas; electric (high-speed) elevators to the Otis Elevator Company, New York; plumbing and heating to the C. Wallace Plumbing Company of Dallas. The cost of the building is estimated at from $250,000 to $300,000.

Pacific and Mountain States

OROVILLE, WASH.—The Town Council has passed an ordinance granting the Okanogan Valley Power Company a franchise to erect and operate electric distribution over the streets and alleys in Oroville for a period of 25 years.

PORT ANGELES, WASH.—The Puget Sound Pulp & Power Company, which proposes to build a large paper mill near Port Angeles, has applied to the Commissioners of Mason County for a 50-year franchise to erect and operate electric transmission lines through Mason County.

SEATTLE, WASH.—Plans have been completed by the Puget Sound Traction, Light & Power Company for the substructure for the coal pulverizing plant to be erected at its Western Avenue power station, at a cost of about $80,000.

TACOMA, WASH.—A substation is being erected at the United States Army station at Camp Lewis. Three 55,000-volt wires will lead into the station. Orders have been received by the construction quartermaster at Camp Lewis for the erection of 175 buildings, at a cost of $112,000, to house 6200 men. Considerable electrical equipment will be required.

EL SEGUNDO, CAL.—Application has been made by the Southern California Edison Company of Los Angeles for a franchise to supply electricity in El Segundo.

FRESNO, CAL.—The Board of Trustees have granted the petition of the property owners for the formation of a lighting district for the installation of electroliers, to start at G and Fresno North Streets to Kearney Boulevard and on the boulevard to the city limits, one-half mile.

LOS ANGELES, CAL.—The Kleinberger & Edwards Company is planning an elaborate lighting system in its Walnut Park tract in the near future. The plans provide for the erection of concrete electroliers for which contract has been placed.

MERCED, CAL.—Plans are now under way by the San Joaquin Light & Power Corporation to enlarge its local substation, increasing the output from 1200 to 2400 kw.

PORTOLA, CAL.—Owing to the destruction by fire of the electric-light plant of the Grizzly Electric Company the town is without electrical service. The loss is placed at about $7,000. The plant, it is understood, will be rebuilt as soon as possible.

SEBASTOPOL, CAL. — The Board of Trustees has accepted the proposal of the Pacific Gas & Electric Company for the installation of a new street-lighting system, to be installed at once.

WOODLAND, CAL. — Steps have been taken by the Farm and Town Club for the installation of additional electroliers on Main Street.

BONNERS FERRY, IDAHO.—The Bonners Ferry Planing Mill, which was recently destroyed by fire, causing a loss of about $40,000, it is reported, will be rebuilt at once. The plans provide for the installation of a 600-hp. turbine engine directly connected to an engine, with individual motors for various machines in the mill.

BENT, N. M.—The Tularosa Copper Basin Mining Company is planning to enlarge its oil reduction mill and install machinery at its mine in Bent. The company also owns a water power on the Tularosa River, where it proposes to build a hydroelectric plant.

FORT STANTON, N. M.—Bids will be received at the office of the custodian of the United States Sanatorium, Fort Stanton, until Nov. 26 for furnishing one 50-kw., two-wire, 110-volt, direct-current electric generating unit, directly connected. Engine to be single-cylinder, non-condensing, piston-valve type, and generator must be capable of operating with a 40-hp. Skinner engine. Bids are desired preferably for new equipment, but a second-hand outfit in good condition will be considered. For details see Searchlight Section.

Canada

ROSSLAND, B. C.—The West Kootenay Power & Light Company is contemplating the erection of a high-tension transmission line from the end of its boundary system in the vicinity of Greenwood, west as far as Copper Mountain, to furnish energy to the Canada Copper Company. The company will also extend its transmission line to Penticton to supply electricity for industrial purposes.

VANCOUVER, B. C.—The contract for electrical work at the Wallace Shipyards Company's foundry on Industrial Island has been awarded to Mundy, Rowland & Company, Standard Building, Vancouver.

TRURO, N. S.—The Town Council has decided upon the extension of the lighting system on Young Street South, and may also extend it on Brunswick Street.

BRADFORD, ONT. — The ratepayers have approved a by-law authorizing an expenditure of $15,600 for the installation of a hydroelectric transmission system.

CHAPLEAU, ONT.—Tenders will be received by the Town Clerk of Chapleau until Nov. 15 for one turbine pump of 400 gal. capacity, operated by a 40-hp. motor. Plans and specifications may be seen at the office of the town clerk at Chapleau or at the office of Chipman & Power, engineers, Mail Building, Toronto.

THORNTON, ONT.—The by-law providing for the installation of a hydroelectric power plant has been approved by the ratepayers.

SHAWINIGAN FALLS, QUE. — Work soon be started on the construction of a dam and power house at St. Narcisse, Que., for the Shawinigan Water & Power Company of Shawinigan Falls. The cost of the project is estimated at $400,000. R. Lindsay of Shawinigan Falls is engineer.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until Nov. 13, for furnishing steel, boiler tubes, steel wire, sheet copper, brass tubing, grommets, cotters, dies, cable clips, etc. Blanks and further information relating to this circular (No. 1178) may be obtained at the above office or at the offices of the assistant purchasing agent, 24 State Street, New York, N. Y.; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, A. H. Krom, 29 South La Salle St., Chicago. Annual meeting, May 14, 1918.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City. Annual meeting, Jan. 14, 1918.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio. Annual meeting, Pittsburgh, Dec. 27-29, 1917.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary-treasurer, Roy B. Fowles, Pine Bluff, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, George C. Holberton, San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, McKeesport, Pa. Annual convention, September, 1918.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, W. L. Connelly, Gibson, Ind.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, R. B. W. Pirie, 406 Yorkshire Building, Vancouver, B. C.

CALIFORNIA ASSOCIATION OF CONTRACTORS AND DEALERS. Secretary, James W. Redpath, 505 Rialto Bldg., San Francisco, Cal.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, Alan Sullivan, Excelsior Life Building, Toronto, Can.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary, F. D. Beardslee, Union Electric Light & Power Co., St. Louis, Mo.

EASTERN NEW YORK SECTION, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRICAL CONTRACTORS' ASSOCIATION OF CONNECTICUT. Secretary, George M. Chapman, Waterbury, Conn. Annual meeting, New Haven, Conn., May, 1918.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, J. E. Wilson, 263 Summer Street, Boston, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo. Annual meeting, Jan. 19, 1918.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE STATE OF PENNSYLVANIA. Secretary, M. G. Sellers, 1518 Sansom St., Phila.

ELECTRICAL DEALERS AND CONTRACTORS' ASSOCIATION OF ONTARIO. Secretary, E. E. Drury, 45 Murray St., Toronto, Can.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, H. B. Crouse, Crouse-Hinds Co., Syracuse, N. Y.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General Secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL CREDIT ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert E. Elliott, 502 Flatiron Building, San Francisco.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago.

ELECTRIC VEHICLE SECTION OF THE N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

FLORIDA ENGINEERING SOCIETY. Secretary J. R. Benton, Gainesville, Fla.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, L. W. W. Morrow, Norman, Okla. Annual meeting May, 1918, Oklahoma City.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, Dan Carey, Atlanta Builders' Exchange, Atlanta, Ga.

ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, L. B. Van Nuys, Central Electric Co., Peoria, Ill. Annual meeting, Chicago, January, 1918.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, R. H. Abbott, Petersburg, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skillman, Indianapolis, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 111 Broadway, N. Y. C.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

IOWA SECTION, N. E. L. A. Secretary-treasurer, L. E. Caldwell, Iowa City, Iowa.

JOVIAN ORDER. Jupiter (president), Henry J. F. Strickland, Dallas, Tex.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, R. M. Sutton, Wichita.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan. Annual meeting, Kansas City, Kan., Oct. 17-19, 1918.

KENTUCKY ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, F. F. Valinoti. Annual meeting, May, 1918, Louisville, Ky.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 323 Chartres St., New Orleans, La.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Augusta, Me.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Detroit Edison Co., Monroe, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, H. E. Young, Minneapolis General Electric Company, Minneapolis, Minn.

MINNESOTA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, G. M. Jones, 112 South Seventh St., Minneapolis, Minn. Annual convention, Jan., 1918, Minneapolis.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary-treasurer, W. F. Wheeler, Hattiesburg.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass. Annual convention, New York, March, 1918.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, H. C. Brown, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill. Annual meeting June 1, 1918.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, N. Y. C. Annual meeting, June, 1918.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 W. 39th St., N.Y.C.

NORTHWEST SECTION, N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus. Annual meeting, Columbus, Ohio, Nov. 15, 1917.

OREGON ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, J. W. Oberender, 302 Dekum Building, Portland, Ore. Annual meeting, September, 1918.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, Crossley Building, San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 152 Beeech St., Yonkers, N. Y.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa. Annual meeting, Evanston, Ill., June, 1918.

SOUTH DAKOTA ELECTRICAL POWER ASSOCIATION. Secretary-treasurer Frederick D. Brown, Huron, S. D.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, T. W. Peteers, Columbus.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, Forrest E. Baker, 721 First National Bank Building, El Paso, Tex.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, H. S. Ashley, Fort Worth, Tex. Annual meeting, Galveston, Tex., June 15, 1918.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. E. Myers, 3 Gould St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer W. F. Steiglitz, Columbia, S. C. Annual meeting, Charlotte, N. C., April, 1918.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt. Annual meeting, February, 1918.

VIRGINIA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. M. Andrews, Richmond.

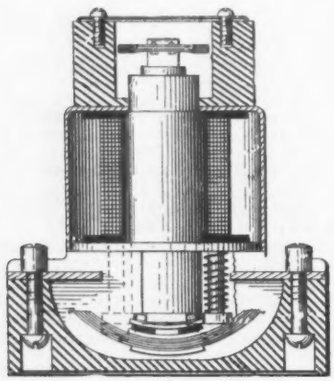
WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 W. Jackson Blvd., Chicago, Ill. Annual meeting, Jan. 29-31, 1918, Memphis, Tenn.

WESTERN SOCIETY OF ENGINEERS. ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis. Annual meeeting, March, 1918.

1,243,703. Window Heater; William C. Burmeister and Edwin N. Smock, Chicago, Ill. App. filed July 21, 1916. Vehicles.

1,243,716. Wire Coiling and Binding Clamp; John Cuthbert, Chicago, Ill. App. filed Feb. 24, 1916. To serve as terminals for electric translating devices and the like.



1,244,085—Switch

1,243,719. Refillable Fuse Cartridge; Jesse T. Dugger, Chattanooga, Tenn. App. filed July 30, 1915. Improvements.

1,243,722. Electric Switch; Clarence T. Evans, Milwaukee, Wis. App. filed April 10, 1914. Provides a power-operated switch with means to prevent accidental operation thereof while released.

1,243,738. Electric Regulator; Gottlob Honold, Stuttgart, Germany. App. filed Aug. 25, 1913. For dynamo-electric machines.

1,243,748. Connector for Electrical Conduits; Adnah McMurtrie, New York, N. Y. App. filed July 3, 1914. May be made of steel, brass or other suitable metal in substantially cylindrical form, split down at least one side and provided near one end with a contracted neck to be inserted in one of the apertures of the outlet box.

1,243,774. Electric Conducting Ground Rod; Gerald W. Soengen, Kirkwood, Mo. App. filed Oct. 30, 1916. Consists of a ground rod having an explosive bomb or cartridge at its lower end which is exploded after the rod is driven into the ground to produce a cavity at the lower end of the rod suitable for filling with an absorbent conducting material.

1,243,800. Electrical Fixture; Carl H. Bissell, Syracuse, N. Y. App. filed Feb. 9, 1917. Efficient arrangement for mounting the cover or cap of a conduit outlet box on the box, which cover or cap carries an electrical appliance.

1,243,807. Rectifier; Henry E. Burket, Leavenworth, Kan. App. filed June 5, 1916. Embodies both rotary and stationary conductors, said rotary conductors being two or more in number and arranged about a common axis driven by a motor in synchronism with the alternations of the current.

1,243,851. Fuse Plug; William S. MacLewee, Yardley, Pa. App. filed Sept. 28, 1916. Improvements.

1,243,902. Electric Conduit Fitting; Samuel B. Van Ranst, Syracuse, N. Y. App. filed Feb. 11, 1910. Designed for use for housing fuse cut-outs, the invention relates particularly to a service entrance fitting for use in connection with electric conduits.

1,243,924. Vehicle Signal; George W. Edmond, El Paso, Tex. App. filed Dec. 1, 1916. Automobiles.

1,243,961. Rubbing Post; Frank F. Miller, Yankton, S. D. App. filed July 13, 1915. One object of the invention is to effect an economy in the use of the oil or other liquid and to permit a limited discharge of the same when an animal rubs against the actuating lever or rubbing bar.

1,243,966. Dynamo-Electric Machine; Louis C. Nichols, Norwood, Ohio. App. filed Jan. 22, 1915. Projecting-pole type; for cases where it is desirable that the reluctance of the magnetic circuit of a field pole be adjustable.

1,243,976. Process for Separation of Gold and Silver from Minerals; Ricardo Reyes, Mexico City, Mex. App. filed Nov. 9, 1914. Improvement.

Record of Electrical Patents

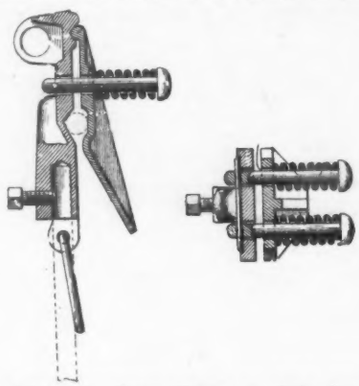
Notes on United States Patents issued on October 23, 1917

1,244,012. Process of Treating Liquids; Frederick R. Bachler, Oxnard, and William B. Newkirk, Los Angeles, Cal. App. filed Dec. 23, 1915. Relates to a process and an apparatus for treating liquids. The principal object of the invention is to provide a process and apparatus especially adapted to purify and decolorize impure sugar solutions.

1,244,013. Vibratory Bell; Antonic Bagutti, Turin, Italy. App. filed Nov. 26, 1913. Improvements.

1,244,048. Carbon Holder for Arc Lights; Joseph Gelb, New York, N. Y. App. filed Feb. 19, 1916. Provides a holder that is arranged so that the carbon holder proper, or socket, can be readily detached from its support or bracket without the necessity of taking the brackets away from the framework of the lamp.

1,244,085. Switch; Gerald W. Hart, West Hartford, Conn. App. filed June 15, 1916. Produces a single-coil remote-controlled switch having two controlling circuits, one for opening and the other for closing the coil, and means for breaking each of said controlling circuits after the solenoid has been actuated either to fully close and lock the switch or to release the lock.



1,244,339—Snap Clamp or Grip for Electrical Conductors

1,244,099. Test Connector for Electric Wires; Arthur Kneisel, Cleveland, Ohio. App. filed Nov. 27, 1911. Consists in mechanically and electrically connecting two or more wires carrying the electric current, such as telephone party-line wires, in an improved manner.

1,244,110. Switch; William R. McNary, Detroit, Mich. App. filed Oct. 25, 1916. For use in connection with motor cars.

1,244,118. Systems of Lightning Conductors; George A. Mullen, Woodbury, N. J. App. filed Nov. 6, 1915. Improvements.

1,244,121. Metallic-Vapor Lamp; Walther Nernst, Berlin, Germany. App. filed Feb. 2, 1914. In this device that part of the lamp which furnishes illumination during its operation contains, before ignition, gases (or air), which, by reason of the seething and boiling of the metal—for instance, mercury—during said operation, are driven completely out of the illuminating space into an auxiliary chamber forming a part of said space, or in the case of air into the atmosphere, and are prevented from re-entering by the continued boiling of the metal, but when the lamp is extinguished again enter into the illuminating space.

1,244,150. Method of Changing Resistance in a Circuit and Apparatus Therefor; Ezechiel Weintraub, Boston, Mass. App. filed April 13, 1916. New type of microphone capable of varying a much larger current than has been possible in the past and of accomplishing this variation in better conformity to the sound variations that are to be reproduced.

1,244,164. Electric Clock; Gustav Blumberg and John A. Butkus, Baltimore, Md. App. filed Oct. 13, 1915. Entirely devoid of springs in the time train.

1,244,216. Electron-Discharge Apparatus and Method of Preparation; Irving Langmuir, Schenectady, N. Y. App. filed June 25, 1917. Improvements.

1,244,217. Electron-Discharge Apparatus and Method of Operating the Same; Irving Langmuir, Schenectady, N. Y. App. filed Oct. 28, 1915. Providing in the envelope a quantity of a vaporizable reagent of low vapor pressure capable of preventing the oxidation of thorium.

1,244,225. Circuit Breaker; Walter S. Mayer, Providence, R. I. App. filed Sept. 30, 1915. Provides an electromagnet having an armature arranged to trip the bridge arm and open the circuit when abnormal conditions occur on the line.

1,244,244. Division Piece or Partition for a Controller Arc Deflector, Circuit Breaker and the Like; Walter R. McRae and Richard Russell, Toronto, Ontario, Can. App. filed Sept. 22, 1917. One of the objects of the invention is so to construct the division pieces or partitions that a considerable percentage of the cost of these repairs and the time during which the controller or other electrical apparatus is out of use can be eliminated, and this is attained by making each division piece or partition in two parts.

1,244,255. Folder Device for Wrapping Machines; William C. Stevens, Akron, Ohio. App. filed May 24, 1915. Improvements.

1,244,332. Fire Alarm System; Harry R. Hughs and Wade C. Hughs, Walhalla, S. C. App. filed Aug. 30, 1916. Automatic.

1,244,334. Protective Device for Ventilating Fans; Robert A. Ilg, Chicago, Ill. App. filed March 3, 1914. Improvements.

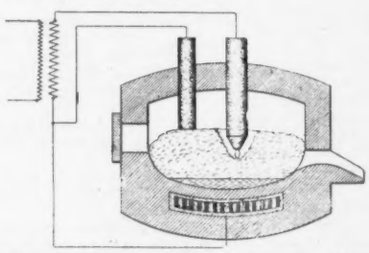
1,244,339. Snap Clamp or Grip for Electrical Conductors; Tominson F. Johnson, Jr., Atlanta, Ga. App. filed Jan. 22, 1917. Provides a construction which will eliminate binding between the clamping jaws and the bolts which serve as supports for the springs pressing the jaws together.

1,244,358. Arc-Lamp Electrode; William R. Mott, Lakewood, Ohio. App. filed Feb. 28, 1916. Particularly adapted to photographic use.

1,244,359. Arc-Lamp Electrode; William R. Mott, Lakewood, Ohio. App. filed Nov. 6, 1916. Relates to a method of treating a rare-earth metal fluoride containing a certain percentage of combined sulphur trioxide (SO_3) as a sulphate impurity, whereby the resulting material is made advantageous for use in arc-lamp electrodes.

1,244,415. Electric Furnace and Method of Operation; William K. Booth, Chicago, Ill. App. filed June 29, 1917. Relates particularly to electric furnaces which operate normally by passing electric current between an upper electrode and a wall or hearth contact, and through the interposed charge which preferably is fused by the arcing of the electric current.

1,244,425. Battery Tester; Emerson L. Clark, Lakewood, Ohio. App. filed Sept. 8, 1914. Testing apparatus which gives an audible signal if the battery current or voltage is up to the standard; otherwise no signal is given.



1,244,415—Electric Furnace and Method of Operation

1,244,441. Auto-Light Dimmer; Arthur J. Frascolla, New York, N. Y. App. filed Jan. 26, 1917. Device in which is provided a resistance coil, the construction of the switch permitting the coil to be included in the circuit or eliminated therefrom at will, for the purpose of regulating the brilliancy of the headlights of vehicles or for other purposes.